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Lakota Intonation and Prosody

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Lakota Intonation and Prosody

Thesis directed by Professor David S. Rood and Professor Rebecca Scarborough

This thesis provides a comprehensive account of the intonational phonology of Lakota, an indigenous North American language of the Siouan family. Lakota is predominantly a verb final language, characterized by complex verbal morphology. The phonological description of Lakota intonation and prosody presented here is based on acoustic analysis of speech data collected from native speakers. The framework of analysis adopts the fundamental tenets of the autosegmental-metrical approach to intonation as originally formulated by Pierrehumbert (1980) and later reformulated and extended by Pierrehumbert & Beckman (1988), Ladd (2009), and others. The dissertation is organized into two major interrelated parts, the first dealing with the tonal and the second with the prosodic properties of Lakota.

The tonal part provides an analysis of the major pitch events in Lakota utterances. I describe the types of pitch accents, their distribution inside phrases with different lengths and structures, and the alignment of these pitch events with respect to the segmental tier. I also provide an analysis of the types of pitch events that occur at the edges of phrases. The description of the intonational events is based on a corpus of declarative and interrogative utterances drawn from narratives and semi-spontaneous speech that sample different speakers, from two different time periods. The results show that the core tone in a pitch accent event in Lakota consists of a high (H) tonal target which can be followed and/or preceded by a low (L) pitch. The majority of accentual high peaks in Lakota are realized within the boundaries of lexically stressed syllables. The trailing L tone, if present, usually occurs in the space of one or two syllables after the stressed syllable. The analysis of the edge tones reveals that Lakota utterances contain boundary tones and intermediate phrase accents. I explore the types of boundary tones and show that the phrase accent is frequent and robust, although there is variation across speakers and genre in terms of the types of phrase accents that are used. I conclude the tonal analysis by considering two prominent aspects of pitch scaling in Lakota phrases.

The first is the phenomenon of downstep and the second is the observation of sudden, and extreme, pitch span compressions. I show that these scaling events apply locally at specific points in an utterance.

The prosodic part of the dissertation is primarily an acoustic and impressionistic phonetic analysis that yields evidence in favor of levels of prosodic structure in Lakota. I provide a detailed description of the segmental and suprasegmental cues associated with the perception of boundary strengths between adjacent words in phrases. This phonetic analysis shows that Lakota utterances can be organized into three levels of supra-lexical prosodic structure: the Intonational Phrase, the Intermediate Phrase, and the Prosodic (phonological) Word. I consider the phenomenon of downstep from the tonal analysis in light of the proposed prosodic structure and show that the application of pitch scaling events is constrained by the prosodic organization. In the final part of the analysis I discuss a few ways in which speech rate and morpho-phonological length influence prosodic phrasing. In particular, I examine the phrasing of several post-verbal enclitics based on the outcomes of a small experimental study. The results show that utterances in Lakota can contain complex prosodic domains. Although the thesis arrives at some interesting theoretical conclusions, it leaves open a number of issues for future research.

For Jaime and Roger.

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It would be nearly impossible to list the names of all the people who have accompanied me throughout this adventure. The study has taken place over the course of several years, during which I have received support from numerous sources. Here, I have tried my best to acknowledge the names of all the people who have played a central role in helping me complete this work. Some who deserve a mention may have been unintentionally left out. I apologize in advance for any such accidental omissions.

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This thesis is about Lakota, a language and culture that inspired me during the very early years of my residence in the United States. As an undergraduate student at UCLA, my interest in learning Lakota grew while I was working on a class project in American Indian Theatre, taught by Dr. Hanay Geiogamah. When I moved to Boulder I was at a good place to continue my quest to learn the Lakota language. I would therefore like to thank all the Lakota people that directly or indirectly shared their knowledge with me and

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Preliminaries

1.1 Introduction

This study is a description and analysis of intonation and prosodic phrasing in Lakota, an indigenous North American language of the Siouan family. The data for the study comes from oral narratives and natural discourse, as well as a small set of semi-elicited sentences, recorded from three Lakota speakers on several different occasions. I use a framework of analysis for Lakota intonation that adopts only the fundamental tenets of the autosegmental-metrical framework as originally formulated by Pierrehumbert (1980) and later reformulated and extended by Pierrehumbert & Beckman (1988), Ladd (2009), and others.

More specifically, I use acoustic phonetic and impressionistic methods to explore the intonation of Lakota constituents at and above the level of the "word". The first area of Lakota intonational phonology I investigate concerns the tonal characteristics of the language. In particular, I describe the inventory, the structure, and the organization of intonational events in phrases and utterances. These events consist of both the core tones and the edge tones. The second area of intonational phonology I investigate concerns the large scale prosodic structure of Lakota. I use tonal, segmental, durational, and vocal cues to quantify levels of prosodic juncture and to provide an analysis of prosodic phrasing in utterances. The principal goal is to develop a theoretically well-defined, yet empirically motivated, representation of Lakota intonation and prosody.

My first motivation for describing Lakota intonation and prosody is to make a new contribution to studies of the Lakota language and to enrich the work done on Siouan languages in general. The majority of linguistic work on Siouan languages is focused on segment-level phonology, morphology, and syntax. To my knowledge there is very little known about post-lexical prosodic structure in any of the Siouan languages. The study presented here provides, for the first time, auditory and visual representations of pitch accents and edge tones in Lakota intonation, as well as a phonological model for transcribing these intonational patterns. Furthermore, the analysis of phonological phrasing lays the groundwork for future investigation on how the prosodic structure interfaces with the morphology, syntax, and discourse organization of the language.

A second motivation for describing the intonation of Lakota is to provide input to the general concerns of intonational phonology from a typologically informed perspective. Investigation of pitch accents and prosody in Lakota can contribute to the clarification of several issues of continuing interest in intonational phonology. These puzzles include, among other things, specific questions concerning the representation of pitch accents and phrase tones, the role of downstep, and the nature of pitch-range variation.

1.2 Definitions, Assumptions, and Expectations

Since intonation and prosody in Lakota have not been previously described in detail, this study has both descriptive and analytical goals. In what follows I first provide some definitions of the terminology that I have used throughout the study. Then I outline the general assumptions that I have made and how these relate to the descriptive component of the investigation. Finally, I outline a set of expectations about Lakota intonation that are tested with the data.

1.2.1 Definitions and Terminology

Some of the terminology employed in this study has been used in the phonological literature in different ways. In this section I explicitly state how I have used some of these terms in order to avoid

potential confusion throughout the investigation.

I use the term *acoustic stress* to refer to a potentially complex set of phonetic properties that signal acoustic salience of a given syllable. These minimally include pitch, duration, intensity, and spectral tilt. I avoid the general term stress because it has been used in the literature in many different ways. Throughout the study I use the term *lexical stress* to refer to the syllable in a Lakota word that is metrically and rhythmically strong. By and large these underlying, metrically strong, syllables are perceived as acoustically stressed because they are generally associated with higher pitch, higher intensity, and longer duration. However, as I will show both in the tonal and in the prosodic parts of the analysis, disassociations do occur in that pitch does not correlate perfectly with lexical stress.

In most of the work considered "intonational phonology", intonation is broadly understood as those suprasegmental phonetic features (including, but not limited to, pitch) which are used to convey utterance and discourse level meanings. In my study I use the term *intonation* to simply refer to those post-lexical tonal events that are produced at phonologically specified points in an utterance. These include pitch accents on lexically stressed syllables and phrase accents and boundary tones at the edges of phrases.

The words tone and tune have also been used in the literature with varied meanings. I use the word *tone* to refer to the level-tone elements - L for low and H for high - which are the basic phonological units that give rise to the events in the intonation of a word or an utterance. A sequence of tones distributed across a word, a phrase, or a larger utterance makes up a melody which I call a *tune*. Therefore, a tune is a particular pitch pattern. One can view a unified sequence of basic, elemental tones as a unit that forms a phonological tune which, upon acoustic realization, is manifested as the fundamental frequency contour.

Another problematic word is the term *suprasegmental*. In this study I have used the term suprasegmental phonetic features to refer to measurable, physically observable quantities that span domains that are larger than the individual phonemic and syllabic segments that make up the language. The most accessible of these measurable quantities are the fundamental frequency of the voice (F0), the intensity of the sound

waves (square of the amplitude), and the duration of elements at word boundaries and above. All of these quantities are observable and generally vary as a function of time.

I use the term *utterance-level* to refer to phonological patterns that emerge from analysis above the level of individual words. Technically, this means that the study excludes things like lexical stress and lexical tone. However, both phonetically and phonologically, there are obvious, cross-linguistically attested, interactions between the lexicon and intonation which cannot be ignored. These interactions have to be accounted for because they can affect the nature and the realization of the global intonational contour.

Finally, I use the terms *prosody* and *prosodic structure* to refer to the phonological structures, manifested via certain phonetic observables, which underly the rhythmic structure of the language. These structures span all the way from the smallest syllable and foot levels to the larger phrasal levels.

1.2.2 Basic Assumptions

I should clarify from the outset that I have made no attempt in this study to justify the existence of lexical stress in Lakota. Previous studies, such as Shaw (1980), Shaw (1985), and Patterson (1990), have addressed the phonology of lexical stress in this language. Throughout my investigation I simply assume that my impression of the word-level prominence corresponds to this lexical stress. The patterns I notice are generally in agreement with the cited studies. The only analysis of lexical stress I provide in the current study is in Chapter 3 (section 3.2.2), where I briefly explore some of the acoustic correlates of the word-level stress system in Lakota.

Every study, no matter how descriptive, contains certain assumptions. In the case of a description of linguistic data the inherent assumptions of the description should be kept as simple and clear as possible. I have, therefore, tried to stay rather general about what is accepted without rigorous proof. For instance, I assume that intonation in Lakota exists and that it can be observed in terms of some real, quantifiable, phonetic measurements. Furthermore, I have taken as given that the most easily accessible form of this

measurement is the fundamental frequency contour. Similar phonetic descriptions of intonation have been attained in many other languages (refer to section 1.5 in this chapter). The Lakota data does not contradict these general observations.

1.2.3 The Descriptive Component

Certain components of this study have a purely descriptive goal. For instance, I primarily use F0 pitch tracks along with syllabic transcriptions to describe the pitch accents and phrasal edge tones. This phonetic description quantifies the types of pitch accents and edge tones in the language and shows how they are associated and aligned with lexical stress. I view the pitch accent and edge tone results from such an analysis as emergent phonological properties. The resulting regularities indicate how crucial phonetic data is in addressing questions of phonological representation. Otherwise, I make no other theoretical claims in the description.

I have also coded the data for levels of juncture between adjacent words. That is, based on phonetic and perceptual cues, I have coded the degree of attachment of nearby words based on a numerical scale. These juncture values are useful indicators of prosodic boundary strengths. As will be clear from the methodology, I have treated the issue of prosodic phrasing primarily as a phonetic and phonological exercise. This method of calculating prosodic phrasing makes no direct references to any particular theory that may used to describe the syntactic or semantic structure of the data.

1.2.4 Expectations and Analytical Goals

At the start of this study I formulated some basic expectations I had about the intonational structure of Lakota. These expectations were partly based on my intuitions and partly based on impressionistic observations I had made during a small pilot study. I have listed the expectations in terms of three hypotheses below.

- Hypothesis 1: Lakota phrases at and above the level of the word contain strings of melodic pitch accent events which are associated with strong, lexically stressed, syllables. These pitch accents generally contain at least a high (H) tone.

- Hypothesis 2: In longer phrases, all major category grammatical words - i.e., all nouns, verbs and adverbs - carry a pitch accent on their lexically stressed syllables. Morphologically complex words that are either compounds or contain enclitics may show secondary pitch excursions associated with secondary lexical stress.

- Hypothesis 3: A Lakota utterance is organized into a prosodic structure that includes Phonological Words, Intermediate Phrases, and larger Intonational Phrases.[1]

The description and analysis of the data, as outlined earlier, provides various tests for these hypotheses, as well as making further descriptive and theoretical claims. In the process of carrying out these tests I make reference to aspects of the autosegmental-metrical theory of intonation and consider portions of the data that have particular phonological, morphological, and syntactic structures.

The results, to be discussed at length in Chapters 3 and 4, generally lend support to hypotheses one and three. Hypothesis two needs to be modified. It appears that in a multi-word Lakota utterance not all major category words necessarily carry a pitch accent. This de-accenting is manifested phonetically in various ways. It is also clear that the phonological phrasing of an utterance (more specifically, the presence or absence of an intermediate phrase boundary) interacts with de-accenting.

[1] It is not clear, at the start of the analysis, if the *Intermediate Phrase* is demarcated by an accentual pattern or by the presence of phrase accent edge tones. The hypothesis here simply claims that there is some intermediate prosodic level of structure that can be larger than the phonological word, but smaller than the intonational phrase.

1.3 Framework of Analysis: Overview of the Autosegmental-Metrical Approach to Intonation

The idea of an autosegmental-metrical (AM) theory for intonation was first proposed in the 1970s by Liberman (1975) and Bruce (1977). It was developed into a comprehensive formalism by Pierrehumbert's (1980) theory of the phonology of English intonation. The application to English has subsequently been modified. The formalism has also been used to analyze intonation in a variety of other languages (see section 1.5 in this chapter).

As the term autosegmental-metrical implies, there are two components to any such theory. These are the autosegmental component and the metrical component. Each component of the model has elements that are universal and elements that are language-specific. In the autosegmental component, the existence of linear tiers of phonological representation, such as a tone tier and a segmental tier, is universal. The type of information coded in each tier (i.e., the number of distinctions that exist in the tiers or the specifics association rules between the tiers) are language-specific. In the metrical portion, the division of various phonological units into relative strong and weak constituents is a universal feature. On the other hand, the levels of constituency, the head-modifier ordering of various elements, and the phonetic realization of the relationship between units are language-specific features.

In what follows I first outline the fundamental principles behind the treatment of tones in AM theory, with specific focus on intonational tones. Then I present a very brief background for the application of the metrical component to phrase-level phonology. I follow these by outlining a feature of AM Theory, the quantization of intonational events, which is a point of contention between different approaches to modeling intonation.

1.3.1 Tones and Segments in AM Theory

The application of AM theory to intonational tunes contains four principles that are based on general autosegmental principles. One of the claims of the autosegmental theory of tones is that there are separate, autonomous, tonal and textual (segmental/syllabic) tiers of representation. The individual, elemental tones live in the tonal tier while the segmental tier houses the structures that represent the phonemes and individual segments of a language. Another autosegmental principle states that there are patterns of tune-text association which anchor specific tones in the tonal tier to segments or syllables in the segmental tier. These two principles imply that the minimal tiers for any tonal (and thereby intonational) analysis include a tonal tier and, either a segmental tier or a syllabic tier.

When applied to larger structures, such as phrases and utterances, these fundamental autosegmental principles imply four basic working assumptions for an intonational analysis (Ladd 2009:44-45). The working assumptions are:

(1) Intonation consists of a linear structure of events that are associated with specific points in the segmental tier of the utterance. The material in-between these events consists of phonetic interpolations.

(2) Pitch accents are intonational events. They are associated with lexically strong syllables but are not necessarily the phonetic essence of acoustic stress.

(3) Pitch accents and edge tones are analyzable as component, level, H (high) and L (low) tones. One can have complex pitch accents of the form LH, HL, and so on.

(4) The phonetic realization of basic tones, or groups of basic tones, involves a scaling that depends on various factors such as emphasis, finality, and discourse structure. The overall F0 trend of an utterance is explained by localized iterated variations of these scaling factors.

These four fundamental tenets, which I have adopted in the current investigation, form the building blocks

of any AM approach to intonation. One consequence of these principles is that there are two types of tonal entities that make up an intonational phrase: the pitch accents and the edge tones. A second consequence is that, for a given language, one has to first figure out what the possible tones in a tune are and how they associate with the segmental tier. The tones line up with the textual tier on the basis of the structure of the tones themselves and the specific metrical representation (see section 1.3.2) of the text in the utterance. At this point an intermediate phonological representation of the tune is available. The last part of the AM principles (the fourth tenet listed above) attempts to provide phonetic implementation rules that map the phonological representation to a phonetic pitch-track contour. These phonetic rules come in different forms. One class of rules is designed to evaluate the tones in terms of locally defined baseline units that provide the scaling for the tonal targets. A second class of rules is used to interpolate the pitch-track contour in between these targets. There are complications with the phonetic implementation rules which I briefly discuss in section 1.3.3.

In the description of English intonation originally set forth by Pierrehumbert (1980), a pitch accent consists of one or two elemental tones. One tone is usually marked with a star (*). This is the central tone, or the nucleus, in the pitch accent. It is phonologically associated with the lexically stressed syllable of the word in the textual tier that carries that pitch accent. The description of English intonation claims that maximally two tones can group together into a single pitch accent. In such cases the two tones are written together with a plus sign. Pierrehumbert's, eventually revised, taxonomy of English intonation posited six possible pitch accent types for English. These are H*, L*, L+H*, L*+H, H+L*, and H*+L.

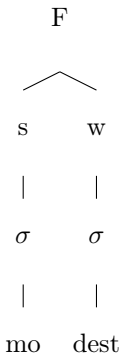
Additionally, Pierrehumbert (1980) proposes that the end of an intonational phrase in English has distinct tonal characteristics apart from the pitch accents. The edge of the intonational phrase consists of a phrase accent plus a boundary tone. The phrase accent occurs after the last (nuclear) pitch accent in the phrase. The boundary tone is placed at the the right edge of the intonational phrase. A well-formed intonational phrase in English, therefore, consists of at least one pitch accent followed by a phrase accent, which is then followed by a boundary tone. There can, of course, be more than one pitch accent in a given

intonational or intermediate phrase. These earlier pitch accents form the head of the tune and are called pre-nuclear accents. In certain approaches to English intonation, the final tonal sequence consisting of the last pitch accent, plus the trailing phrase accent, plus the boundary tone is viewed as a single choice, or a significant tonal unit, inside a tune. The revised version of the analysis of English intonation (Beckman & Pierrehumbert 1986) posits an additional layer of structure, called the *intermediate phrase*, and claims that the phrase accent is a property of the intermediate phrase.

1.3.2 The Metrical Component of AM Theory

The AM approach to intonational phonology adopts the basic metrical principles from lexical phonology and applies them to phrase-sized structures. One of the basic principles in metrical phonology is the relative strong-weak or weak-strong relationship that holds between elements within a given phonological domain. For example, a disyllabic word such as "modest" is metrically organized into a foot such that the first syllable is strong while the second syllable is weak. This left-headed foot structure is represented metrically as follows.[2]

Diagram 1



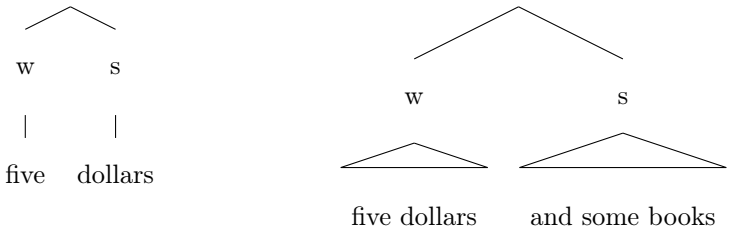
Syllables are organized into feet according to these relative strength relations. Subsequently, feet are organized into a larger structure via strong-weak relationships as well. At any given level there is a designated element that has the greatest metrical strength. Generally, the vowel in the syllable with the

[2] I provide examples of the metrical representation of Lakota words in the discussion of word boundaries, in Chapter 4, section 4.2.

greatest metrical strength receives full quality, has longer duration, and is the unit that can carry a pitch accent when the word is inserted into a larger prosodic context.

The metrical component of the AM approach to intonation extends this organization beyond the lexical level. Different parts of a constituent or a phrase are grouped into metrical structures such that the phrase as a whole has a designated element that carries the greatest metrical strength. For example, predicate or broad focus phrases (i.e., phrases without any contrastive or narrow meaning implied on any part) such as "five dollars" or "five dollars and some books" are organized into weak and strong metrical nodes which can be represented with metrical tree diagrams shown below.[3]

Diagram 2



In a language like English the pitch accents are organized in such a way that the nuclear accent is the designated, strong, element at the phrase level. In this way the metrical relationships provide phonological organization to intonational tunes. The metrical organization has several implications. One consequence is that a tune has one element, called the nucleus, which is obligatory and primary to having a well defined tune. This central tone is the strong element in the metrical structure. There can be optional, context-dependent, prenuclear accents in a tune; these prenuclear accents are the weak elements in the larger metrical structure of an utterance. Furthermore, in English, postnuclear stressed syllables are generally de-accented. However, sometimes there are tonal events after the nuclear accent that are related to stress and prominence. These postnuclear accents, when present, are secondary in relation to the main, preceding, nuclear accent. The postnuclear accents are also represented as weak elements in the larger metrical organization of the utterance.[4]

[3] These examples are adapted versions from Ladd (2009:273). I do not discuss the details of the definition of broad and narrow focus. These are primarily pragmatic categories. Ladd has extensive discussion of the relation of focus with phrasing in chapters six and seven of his text.

[4] There are some important differences between prenuclear and postnuclear accents in English, which I do not discuss in detail here. Interested readers can refer to Ladd (2009:281-287) for further discussion of this issue.

1.3.3 Quantization of Intonation in AM Theory

Proponents of the AM approach to intonation (Bruce 1977; Pierrehumbert 1980; Ladd 2009) argue strongly that intonation is linguistically structured into categorical events. This requirement is fundamentally one of quantization and it needs some justification since - unlike distinctions in segmental phonology - it is not very intuitive to view intonation in categorical terms. Intonation is often represented with pitch-track contours which vary in a continuous, non-categorical, fashion. The idea of a categorical nature of intonation arose in the very process of describing the forms and functions of intonation. Certain observations lend strong support to this quantized view, while other observations complicate matters and cast doubt on the validity of this quantization.

There are three general theoretical and empirical observations that support a categorical view of intonation. The first argument for quantization is primarily theoretical. It concerns the fact that at the segmental level phonological features in languages are quantized into discrete sets of values (such as +voice and -voice for the voicing feature). There is no a priori reason to expect post-lexical suprasegmental features to be continuous rather than discrete. The second argument for quantization is empirical. Phonologists working across many different languages have shown that there are manifestations of the categorical nature of suprasegmental features which have observable consequences. For instance, Bolinger (1986), Bolinger (1989), and Gussenhoven (1984) have developed the idea of "intonational morphemes" by looking at meanings expressed by specific intonational nuances. Ladd (1978) applies the idea of quantized levels of meaning to the specific case of stylized contours. The third, and perhaps most important, argument in favor of quantization concerns the explanatory power of such models. The assumption that intonational features are categorical allows us to synthesize different approaches to intonation which are, by themselves, sometimes inconsistent or have unresolved issues. Certain purely phonetic/continuous approaches to intonation have suffered from the fact that some of the assumptions made by such theories simply do not hold-up to observation. For instance, one type of phonetic approach to intonation (Fujisaki 1983) treats the F0 contour in terms of an *overlay model* in which the complex pitch contour is assumed to be composed of simpler, basis functions

superimposed on top of each other. One basis involves a phrase command that is modeled as an impulse function. In a given utterance, this phrase component is intended to have a relationship with the prosodic structure. However, this condition cannot be empirically met in many types of utterances. Another issue with the overlay models is that, frequently, the function of a pitch feature is assumed to be reflected in the domain over which it extends phonetically (Ladd 2009:31). Empirically, this claim is not true. There are many instances in which the function of a pitch feature is phrasal yet its phonetic extent is extremely localized.

More recently, new phonetic approaches have been proposed which provide very successful models for describing some of the observable patterns of intonation. Most of this work has been in the context of speech recognition and speech synthesis. For example, Taylor (2000) introduces the Tilt model for intonation. The Tilt model is capable of automatically analyzing and generating many acceptable intonational patterns for English. Taylor's approach is, in some sense, a fairly intuitive mixture of the AM model and the continuous aspects of intonation. Tilt has some of the properties of the AM formalism in that the basic units in the model are localized intonational events consisting of pitch accents and boundary tones with just interpolation in between. Yet, Tilt is a phonetic model since it uses a set of continuous parameters to model the local shape of events in the F0 contour.

From this discussion it is clear that - either viewed in terms of the AM approach or in terms of mixed phonetic and phonological models - continuous phonetic variables strongly interact with phonological intonational features. These complex interactions need to be accounted for in any formalism of intonation. The AM theory of intonation, although categorical and quantized, does not ignore phonetic parameters. On the contrary, a major component of the development of an AM model for intonation is the formulation of phonetic implementation rules. Quantization of events functions as a principle in AM theories of intonation. Once this principle is adopted, AM theory adopts (i) the phonological goal of characterizing intonation contours in terms of strings of categorically distinct tonal events and (ii) the phonetic goal of providing the mapping of these basic discrete phonological elements into a continuous fundamental frequency (F0) contour.

1.4 Relevant Issues and Puzzles in Intonational Phonology

In this section I outline several outstanding difficulties that arise in an AM analysis of the intonational and prosodic phonology. Here I briefly address the issues concerning tones and tonal organization and how they relate to the analysis of prosodic phrasing in AM terms.

1.4.1 Identifying Core Tones

One of the outstanding problems in studies of intonation concerns that of the identification of tonal events. Namely, how does one decide whether there is a tone at a given point in an utterance? What criteria could one use for this identification? Furthermore, once a tone has been identified, how does one decide what the makeup of the given tone is in terms of the basic L and H targets?

Bruce (1977) identifies tones using the turning points in the F0 contour of accented words in Swedish. A valley is identified as a low, L, tone and a peak is identified as high, H, tone. However, it is not clear if this simple equation is applicable in all cases and for all languages. One complication is that, frequently, there are segmental phonetic perturbations of the F0 contour which interfere with this procedural identification. Some of these segmental perturbations are language dependent, phonetically not well understood, and rather difficult to model. These complications are especially significant in Lakota since the phonemic inventory of this language includes 15 voiceless stops, one set of which is glottalized.

Another complication involves the often cited observation that a given tone, in a sequence of tones, can be truncated or undershot depending on context. For example, an L tone may not be realized as much of a valley in the F0 contour depending on the timing of the nearby tones. For these kinds of reasons, Pierrehumbert (1980) rejects Bruce's equation in her analysis of English intonation. Pierrehumbert argues that the L tone in the English H*+L pitch accent, for instance, does not usually appear as a turning point at all; it simply serves to downstep the next pitch accent. There are other problems with Pierrehumbert's analysis

that are related to the definition of phrase accents and downstep, but the issue she raises concerning the simple relation tone=turning point remains valid. Pierrehumbert also points out that there are places in certain contours where there appear to be valleys that are simply transitions between two high tones; these valleys, although acoustically turning points, may not necessarily represent low target tones.

These puzzling views of the phonetic representation of tones in the F0 contour are crucial to the current investigation. In an initial analysis of the tonal characteristics of Lakota there are valid reasons to want to rely on Burce's simple equation between tones and turning points; this type of an approach avoids proposing ad-hoc tones that may be realized in very indirect ways. Yet, there are also good reasons to be careful to not place tones where there are purely phonetic interpolations and perturbations taking place. In such cases intuitive and impressionistic observation play a significant role in making target decisions.

1.4.2 Issues Concerning Organization of Tones

A second major issue, related to the tonal identification problem discussed above, concerns the organization of individual tones. One of the claims of AM theory is that pitch accents can be complex; a sequence of tones can group into a bitonal or tri-tonal complex pitch accent that is associated with a single strong syllable. Pierrehumbert (1980) assumes that pitch accents in English are maximally bitonal. That is, one cannot have a sequence of three tones L .. H .. L organized into a single LH*L pitch accent in English. On the other hand, Grice (1995), addressing the same issue in the context of question intonation in Palmero Italian, argues that in this dialect of Italian the nuclear pitch accent of question utterances has the tri-tonal LH*L structure. In a standard Pierrehumbert-like analysis, which does not allow for tri-tonal accents, one would say that the sequence {L H* L} consists of a head L tone followed by an H*L pitch accent, or an LH* pitch accent followed by an L phrase accent.

There are also ambiguities regarding the organization of the pitch accents into larger tunes. The F0 contour, viewed simply at a surface level, is the phonetic realization of a flat linear string of tones. Several

outstanding questions immediately arise. Are these sequences of events simply flat or is there some internal structure whereby certain pitch events somehow belong together? The existence of such structures would imply a higher level of organization inside intonational tunes, without any obvious phonetic correlates. AM theory claims that, from a phonological perspective, a linear string of pitch events can have an internal constituency of its own. Gussenhoven (1983) elaborates on this question at length. He proposes that, even within a given language, there are different possible organizations and realizations of a sequence of tones depending on factors such as prosodic structure and speech rate. According to this view, a sequence of tones such as H .. L .. H .. L can be realized in any one of the following forms: (1) H*L .. H*L, (2) H* .. LH*L, or (3) H* .. H*L. In form (1) there are two bitonal pitch accents. In form (2) there is one simple pitch accent and one tri-tonal complex pitch accent. In form (3) the intermediate L tone is simply deleted. Once again, the original Pierrehumbert analysis does not propose such fluidity and organization to tonal events.

1.4.3 The Phrase Accent Problem

The idea of a phrase accent has been the topic of debate in AM theories of intonation since it was first introduced. There are many complex phonetic and phonological issues surrounding the concept. A full discussion of all the problems is beyond the scope of this introduction; such discussions can be found in Ladd (2009). Here I simply introduce the phrase accent and make a few remarks about its problematic nature.

The phrase accent was originally introduced by Bruce (1977) who showed that Swedish intonation contours contained a peak at the end of the focused word of a phrase. He analyzed this peak as an H phrase accent. Pierrehumbert (1980) borrowed this concept for English, claiming that the nuclear accent of the phrase is followed by either an L or an H phrase accent. The L phrase accent is usually a stretch of low pitch that starts at the end of the last (nuclear) pitch accent and continues so until the final boundary tone. The H phrase accent is harder to define since it is sometimes unclear as to where in the phrase it actually occurs. In some contexts it appears as a stretch of rising tone that starts at the last pitch accent and continues to rise until the boundary tone. In other contexts, such as the chanted calling tune, a sustained (downstepped) high

tone appears before the boundary tone. Ladd (2009:102-103) acknowledges the problems with the analysis of these postnuclear high tones, but argues that the calling contour in many European languages (including English) provides good justification for the existence of an H phrase accent.

The issue of the existence of phrase accents is also tied to the phonological analysis of certain types of complex core tones. In particular, when a falling H*+L pitch accent occurs in nuclear position, it is not always clear if the trailing L tone is part of the core tone or if it is simply an L phrase accent following an H* pitch accent. Gussenhoven *et al.*'s (2003) AM analysis of Dutch intonation does not make use of phrase accents at all. Instead, it consistently uses the H*+L pitch accent. Numerous other researchers have also argued that there is really no obvious reason to posit a phrase accent for many languages, including English. However, the fact that phrase accents exhibit tonal spreading provides some evidence in favor of the existence of a type of tonal event that is different from the (typically) non-spreading pitch accents. Furthermore, recent research on the association and alignment of tones relative to the segmental tier has demonstrated that there is a certain degree of reality to phrase accents. The most important discovery concerns the patterns of association of post-nuclear accents, both in English and in several other languages. Grice *et al.* (2000) illustrate the patterns of association of post-nuclear accents for Greek. They show that there is a post-nuclear H tone in Greek questions which can optionally appear as a trailing edge tone or link to a post-nuclear stressed syllable, if such a syllable is available in post-focal position in the textual tier. Lickley *et al.* (2005) have shown that the falling-rising question tones in Dutch also exhibit this kind of optional linking.

Before leaving this discussion I should add that my analysis of the Lakota data for this study has revealed plenty of evidence in favor of a phrase accent entity in the language. These phrase accents appear frequently in connected narrative discourse and play a significant role in phonological phrasing of utterances. I present the results of my phrase accent analysis for Lakota in the tonal description in sections 3.3 and 3.4. I revisit the idea in the description of prosodic phrasing in Chapter 4.

1.4.4 Concerning Prosodic Phrasing

Questions relevant to the organization of tones, and the phrase accent problem discussed above, are related to the treatment of prosodic phrasing in AM theory. How does one determine how phonological structures are grouped together prosodically? This is an area of analysis in which the metrical and the autosegmental components of AM theory come together.

It is generally assumed that one of the basic functions of intonation and prosodic phrasing is to divide a stream of speech into analyzable units (Ladd 2009:288). However, the definitions of prosodic boundaries in the literature are often circular. One of the basic problems is that many researchers have tried to define prosodic boundaries in syntactic terms. For instance, Nespor & Vogel (1986) define a prosodic unit called the "phonological phrase" in generative syntactic terms. This is despite the fact that the central claim of their theory of prosodic phonology is that prosodic units are domains of application of phonological rules; syntactic domains are only supposed to be indirectly related to the prosodic phrasing.

Certain AM approaches to intonational phonology have made a significant headway toward providing a consistent definition of prosodic phrasing. Such approaches generally define prosodic boundaries primarily in terms of phonetic and phonological factors. For example, phonetic cues to the phrasing of constituents may involve segmental phonetic processes at/within boundaries, tonal events such as the phrase accents and pitch scale changes, and durational parameters such as lengthening and pauses. These cues can be determined by carefully analyzing data from language use. As mentioned earlier, I have taken this phonetic/phonological approach toward the definition of prosodic phrasing in Lakota.

1.5 Previous Studies with Similar Concerns

1.5.1 AM Studies of Intonation and Prosody

In the past three decades many linguists have worked on pitch accent, intonational structure, and prosodic phrasing. Some of the studies have been very general, primarily interested in theoretical issues, while others have been more descriptive, attempting to test the proposed intonational theories in the grammatical domain of a particular language. I have already cited a few of these studies above while discussing the fundamental concerns and issues of my investigation. Here I briefly discuss some more studies that have used the AM framework to (a) analyze intonation in various languages and (b) to address concerns similar to the ones being addressed in this work. The literature review here is not exhaustive of all such studies on intonation; it merely represents a relevant cross-section, while highlighting the fact that the AM theory of intonation is flexible enough to be applicable - with slight modifications - to a variety of languages.[5] The cited studies also illustrate that some of the fundamental concerns with the AM approach to intonation are by no means resolved.

The original application of autosegmental-metrical phonology to the intonational structure of English by Pierrehumbert (1980) is perhaps the best known and most cited work that attempts a phonological, yet phonetically accountable, description of intonation. Pierrehumbert and Beckman (1988) discuss tonal patterns of Tokyo Japanese and their phonetic interpretation in terms of the fundamental frequency contour. Bruce's 1977 study concerns word accent types and intonational phenomena in Swedish. Gussenhoven (1983), discussing Dutch and English intonation, addresses questions about tones and their phonological organization. Uhmann (1988) focuses on the phonological organization of tones by looking at intonation in German. Grice (1995) addresses similar issues for Palmero Italian. Sosa (1991 and 1999) provides an extensive AM-based analysis of intonation in several varieties of Latin American Spanish. Hayes & Lahiri (1991) provide an application of the AM framework to the intonation of Bengali. Jun's (1993) dissertation is a de-

[5] The sample of AM-based studies of intonation cited in this section simply represents the part of the literature that I know best. A more comprehensive review of the AM-based work on intonation is provided by the references in Ladd (2009).

tailed account of the phonetics and phonology of Korean prosody. Jun proposes an accentual phrase prosodic level in Korean and provides detailed phonetic evidence for such a level of representation. She goes on to show how this phrasing is differentiated from the intonational phrase in Korean and that it interacts with syntactic and discourse factors. Ladd (1996) and (2009) discusses problems with Pierrehumbert's original application of the AM theory to intonation. Ladd (2009) argues that certain clarifications and modifications of this early approach can help provide better theoretical descriptions of pitch accents, tonal organization, and prosodic structure across different languages.

1.5.2 Typologically Informed Studies with Similar Goals

There has been some work done on intonation and prosody in languages that are typologically diverse. Of special interest are languages which are structurally more similar to Lakota. Previous studies of intonation that are typologically closest to Lakota are those done on indigenous languages of the Americas and Australia. Most of these studies address the intonation and prosody in polysynthetic languages. Although Lakota is not a prototypical polysynthetic language, it is a head-marking language with definite polysynthetic tendencies.

A polysynthetic language is defined by Comrie (1989) as a language in which it is possible to combine a large number of grammatical and lexical morphemes into single words. One can further divide polysynthetic languages into subtypes based on several morphological and syntactic factors (Baker 1996). For instance, some polysynthetic languages, such as Wichita (Caddoan, North America), allow noun-incorporation into the verbal complex while others, such as Greenlandic, do not allow noun incorporation. In either case however, most polysynthetic languages are distinguished by the fact that there is one word in the clause (usually the the verb complex) which carries most of the semantic information in the utterance. These "words" often correspond to whole sentences in isolating and analytical languages like Chinese or English, for example. In addition, polysynthetic languages typically code the relation between a head and its dependents in the clause by morphological markings on the head word. In this sense, polysynthetic languages are also extreme cases of head-marking language types (Valin & LaPolla 1997:23-25).

A brief literature review of the studies of prosody and tone in polysynthetic languages indicates that there is a wide spectrum of functional possibilities in the way that tonal information is used. McDonough (1999) and prior studies have shown that Navajo has lexical tone. Gordon (2005) describes Chickasaw as a lexical pitch accent language that also has a three-way stress distinction. Gordon also provides a basic description of pitch accents, boundary tones, and prosodic phrasing in Chickasaw. Nagono-Madsen & Bredvad-Jensen (1995) show that read texts in Western Greenlandic only have phrasal edge tones that delimit phonological phrases. That is, in at least this style of intonation, this language has no significant pitch accent excursions on strong syllables.

Bishop (2003) uses the AM formalism to discuss aspects of intonation and prosody in Bininj Gun-wok, a polysynthetic language indigenous to Australia. Bishop describes the metrical stress system of this language and analyzes the acoustic realization of these metrical patterns. She then looks into the association of pitch accents to metrically strong locations in words. Bishop also provides evidence in favor of a phonological phrase in Bininj Gun-wok; this is a level of prosodic constituency larger than a word but smaller than an intonational phrase.

O'Rourke (2005) provides a description of intonational features of Cuzco Quechua. This study is cast within an autosegmental framework. Quechua is an agglutinative language with polysynthetic tendencies. O'Rourke shows that even though this variety of Quechua has a range of morphology for marking modalities, evidentiality, and focus/topic distinctions, there are nevertheless certain interesting intonational distinctions in the language. These include the specific alignment of pitch accent peaks relative to the text and the types of boundary tones that the language employs. O'Rourke's main thesis is concerned with another issue which is relevant to my investigation. O'Rourke explores changes in intonational systems that result from shifts and borrowings in language contact situations. To investigate this area of language contact she compares the intonational patterns of two varieties of Spanish with the patterns found in Cuzco Quechua. The questions raised in O'Rourke's work are relevant here because, in the case of modern Lakota, we are investigating the intonation of mainly bilingual speakers who have fluent knowledge of both English and Lakota. To what

extent does the intonational system of one language affect the other? This issue does arise in my data, especially when comparison is made between speakers from different time periods. I discuss this matter briefly in Chapter 3 (section 3.3.4.2), in the context of the types of phrase accents that emerge from different sets of data. A full study of the question of language contact and intonational borrowing is, however, beyond the scope of this thesis.

A recent study by Cho (2006) briefly addresses some of the intonational characteristics of Lakota. The main topic of Cho's investigation concerns the phonetic cues to lexical stress in Lakota (which I also analyze in Chapter 3, section 3.2.2). However, Cho also looks at pitch accents and one type of edge tone in a few Lakota sentences. Despite being very clear and well written, the study, due to its very brief nature, leaves many areas of Lakota intonation unexplored. Some of these unexplored questions are as follows.

- Cho does not discuss the possibility of different kinds of pitch accents in Lakota. I cover this in my tonal analysis in Chapter 3.
- Cho does not investigate any aspects of prosodic phrasing of longer phrases, nor does he mention the possibility of the existence of phrase accents. The analysis in this chapter shows that there is plenty of evidence for a phrase-accent-like entity in Lakota.
- Cho does not examine the intonation of different kinds of sentences with different types and number of post-verbal enclitics (for example, interrogatives versus declaratives). In my investigation I look at structures with different modalities and enclitics (see Chapter 4, section 4.5).

I have some general concerns about Cho's analysis as well. At a few points in the discussion, especially on the pitch accents and intonation, Cho does not address some of the lexical phonological and morphosyntactic aspects of Lakota that might be very relevant to the observations he has made. Furthermore, although Cho does not discuss the nature of his data in detail, almost all the Lakota words and phrases in his study seem to be based on context-free elicitations.

1.6 A Brief Note on the Lakota Language

Lakota is a dialect of a group of languages spoken in the northern plains of North America.[6] There are four languages that are very closely related to Lakota. Parks (1992) discusses the results of an extensive survey of the reservations (in the United States) and the reserves (in Canada) where the various dialects are spoken. He names the five related dialects as:

- Teton (commonly referred to as Lakota)
- Santee-Sisseton (commonly referred to as Dakota)
- Yankton-Yanktonai (closely related to Santee-Sisseton Dakota)
- Assniboine (the northern dialect, referred to as Nakoda by the speakers)
- Stoney (also known as Nakoda)

According to the New Lakota Dictionary, the Lakota and the Dakota languages are mutually intelligible to a large extent (Ullrich 2008:2). The Dakota language itself consists of two dialects: Santee-Sisseton (Eastern Dakota) and Yankton-Yanktonai (Western Dakota). The northern Nakoda languages, spoken by the Assiniboine and Stoney tribes, are not intelligible to Lakota and Dakota speakers (Ullrich 2008:2). As such, the Nakoda languages are not considered as close dialects of Lakota-Dakota in the New Lakota Dictionary. Large scale typological reconstruction for broader grouping of indigenous North American languages provides good evidence that the Lakota-Dakota-Nakoda languages belong to the Mississippi Valley branch of the Siouan Language Family (Mithune 1999).

The data for my study of intonation comes only from speakers of the Teton dialect. I will refer to this language by the name of Lakota[7] throughout my work. Each of the dialects mentioned above has sub-dialects

[6] The term "northern plains of North America" refers to rather wide geographic range that extends, approximately, from the upper mid-west of the United States into Canada.

[7] I have followed the convention by Ullrich (2008) in writing the name of the language as "Lakota" when mentioning it in English. The pronunciation of this word by native speakers, when speaking in Lakota, is written as *Lakȟóta* in the phonemic transcription followed by Ullrich. In certain places in the literature, such as Rood & Taylor (1996), the name of the language is written as "Lakhota".

within their respective population of speakers. The Lakota sub-dialects have a primary distinction between the southwestern groups, spoken by people from the Pine Ridge and Rosebud reservations, and the Missouri River groups, spoken at the Cheyenne River and Standing Rock reservations.

Lakota can be characterized structurally as an inflectional language, although, as mentioned earlier, it exhibits certain polysynthetic tendencies. The language has complex verbal affixes that incorporate information about person, number, tense, instruments, locatives, aspect, mood, and various degrees of speaker perspective. In what follows I briefly discuss some of the grammatical properties of Lakota using a few examples.

The phrase in example (1) illustrates the typical patterns of pro-drop and verb-final word order in Lakota.[8] In the morpheme-by-morpheme gloss in example (1), the abbreviation *pp* signifies "postposition" and *1.sg.pat* signifies "first person, singular, patient". A list of all the abbreviations I have used for glossing the Lakota morphemes is included in Appendix B.

(1) *matȟó wakpá él imáčhaǧe*

matȟó wakpá él i-ma-čháǧe

bear creek at$_{PP}$ 1.sg.pat$_{infix}$-grow.up

"I grew up at Bear Creek." [Speaker L408:C]

Example (1) also reveals several of the outstanding features of Lakota morpho-syntax. The particle *él*, placed after the noun phrase *matȟó wakpá*, functions as a locative postposition. There are about 35 different postpositional forms in Lakota. Most of these particles can attach to demonstrative roots, forming spatial-temporal locative adverbs. Another important feature in example (1) is the first person pronominal (patient) marker *ma-* which appears as an infix on the verb.[9] In Lakota, the first and second person pronominal markers

[8] There are a number of enclitics in Lakota that can appear in post-verbal position; refer to table 4.1 on page 152 (Chapter 4) for a list of these enclitics. The term "verb-final" in Lakota generally refers to the last major category word in the clause.

[9] Also notable in example (1) is the placement of lexical stress in morphologically complex forms. The last word *imáčhaǧe*, "I grew up", has second syllable stress . The unmarked, third person singular form of this verb is *ičháǧe*, "he/she grew up", which

- for both agent and patient roles - generally appear as verbal prefixes (or infixes, depending on the verb). The third person singular is not marked on the verb. The third person plural (human) object/patients are marked with a prefix, while third person subject/agents are marked by a suffix-enclitic. Because of these pronominal markers independent pronouns and nouns are often sub-lexicalized in discourse. The regular paradigm for the pronominal affixes is summarized in table 1.1.

	Agent Paradigm		Patient Paradigm	
	singular	plural	singular	plural
1*st*	wa-	uŋ(k)-...-pi	ma-	uŋ(k)-...-pi
2*nd*	ya-	ya-...-pi	ni-	ni-...-pi
3*rd*		-pi		wičha-

Table 1.1: The basic paradigm of Agent and Patient Pronominal Affixes in Lakota.

Intransitive verbs in Lakota classify into two classes: the stative intransitives which accept object pronominal prefixes and the active intransitives which accept subject pronominal prefixes. The verb in example (1) is a stative intransitive verb, taking on the object affix *ma-* for coding of first person.

I mentioned earlier that the typical order of elements in Lakota sentences is verb-final. However, the actual situation in real speech is more complex. Example (2) below, from an autobiographical narrative, illustrates a slightly more complex syntactic pattern. The entire utterance contains a transitive verb along with lexically expressed object and subject.

(2)	*oyáte*	*ki*	,	*nakúŋ*	*ówičhakiye*	,	*kakáwaye*	*ki*	*hé*
	oyáte	=ki		nakúŋ	ó-wičha-kiye		kakáwaye	=ki	hé
	people	DET_{def}		also	3.pl.pat_{infix}-help		my grandfather	DET_{def}	that_{DEM}

"The people, he helped them too, that grandfather of mine." [Speaker DBW09:N]

also has second syllable stress. The addition of the pronominal patient marking infix *ma-* causes the stress to move so that it is still placed on the second syllable. I discuss the patterns of Lakota lexical stress in more detail in Chapter 3, section 3.2.1.

First note that the object NP *oyáte ki*, "the people", appears initially. This NP is followed by a pause (indicated by a "," in the Lakota transcription tier). The core of the utterance comes next. It contains a conjunction followed by the transitive verb. The verb carries the affix *wičha-* for 3rd person plural object/patient, referring to the NP object in the dislocated, initial, position. The verb is followed by another pause, which is then followed by an NP lexical mention of the subject. The subject is anaphoric here; it is referring back to a participant that is given from the previous parts of the discourse. I analyze the intonational aspects of example (2) later, in both the tonal and the prosodic parts of this study.

The examples and the brief note here serve as an orientation toward the clause structures in Lakota. A full exploration of Lakota grammar is not the goal of this dissertation. Complete grammatical descriptions of Lakota phonology, morphology, and syntax can be found in Boas & Deloria (1941), Rood & Taylor (1996), and Ullrich (2008). In various sections throughout Chapters 2, 3, and 4, I comment on a few more aspects of Lakota phonology, morphology, and syntax whenever these are necessary or relevant to the data analysis.

1.7 Thesis Overview

The structure of Lakota intonation, along with the contribution it makes to theories of intonational and prosodic phonology, is the subject of the remainder of this thesis. I have organized the description and presentation of results as follows.

Chapter 2 outlines the methodology employed for the current study. I discuss the corpus of material collected and its relevance to describing intonation and prosody. I review the ToBI model for the transcription of intonational events and boundaries and present the specific ways in which I have adapted this to the annotation of Lakota intonation. I outline how the study relies on surface tonal events in the F0 contour, both in terms of locations of peaks and valleys relative to the segmental tier and in terms of pitch range variations. I conclude this chapter with a description of some of the ambiguities and issues with the methodology and how they are handled in the study.

Chapter 3 presents the tonal analysis of Lakota utterances. I start by briefly discussing the phonetic properties of lexical stress and the association of pitch peaks with these strong syllables. Then, using subsets of sentences from the data described in Chapter 2, I investigate the shapes and types of pitch accents and edge tones in (i) Lakota declarative utterances and (ii) Lakota interrogative utterances, including both yes/no and pronominal questions. I consider how these pitch events are distributed and show that not all major-category words in an utterance carry pitch accents. I describe how most of the data shows evidence for both boundary tones and phrase accents. Finally, I describe the observed patterns of downtrend, with special focus on downstep and pitch span compression in declarative utterances.

Chapter 4 is an analysis of the prosodic properties of Lakota utterances. Using examples from the entire database I describe in detail the phonetic (tonal, segmental, and vocal) cues that demarcate adjacent word boundary strengths. Based on this analysis I propose three levels of prosodic structure in Lakota and describe how post-tonic phonological and morphological length can influence this phrasing. I also describe how one type of morpho-syntactically complex structure (i.e., constructions involving post-verbal enclitics) prosodically groups with the remaining parts of the utterance.

Chapter 5 is an overall discussion of the results and conclusions from this study. In addition, I discuss several remaining questions and ambiguities which provide directions for future research into the area of Lakota intonational phonology.

Chapter 2

Methodology : Data Collection and Analysis

2.1 Introduction

In this chapter on methodology, I describe the procedure that was used for collecting, annotating, and analyzing the Lakota data. First, in section 2.2, I provide some information regarding the Lakota participants for this study and discuss the recording procedures that were used in each data set. Then, in section 2.3, I describe each part of the data in terms of the tasks that were performed by the participants and how each piece of the data is extracted for analysis. In sections 2.4 and 2.5 I discuss the orthography, transcription methods, and coding system I use for annotating both segmental and tonal information for the Lakota phrases. I conclude this chapter with a discussion of some methodological ambiguities and how they are addressed. In subsequent chapters, I give additional descriptions regarding measurement procedures specific to each chapter.

2.2 Participants and Recording Procedures

2.2.1 Lakota Participants for this Study

The data for this study is varied and comes from a variety of sources. The Lakota participants who have contributed to the database are listed in table 2.1, according to their name, gender, and year

of recording. For each speaker, I have also indicated the location where the recordings were made. The last column in table 2.1, labeled "Abbreviation", indicates a short code that I use throughout this study to identify the speaker that a particular data clip comes from. Each abbreviation corresponds to the person's initials, followed by the year of recording.

Speaker	Gender	Year of Recording	Location	Abbreviation
Sofie One Feather	F	1973	Mc Laughlin (SD)	SOF73
Paul Red Star	M	1973	Pine Ridge (SD)	PRS73
Della Bad Wound	F	2006	Boulder (CO)	DBW06
		2008	Denver (CO)	DBW08
		2009	Boulder (CO)	DBW09

Table 2.1: Lakota speakers that have contributed to the database used in this study.

The recordings from 1973 were made at various reservations in South Dakota. The speaker recorded in the Denver area between 2006 and 2009 was born and raised in South Dakota as well. All participants are bilingual speakers of Lakota and English. The ages of the speakers at the time of the recording varied.

2.2.2 Recording Procedures

The data for this analysis is divided into two basic units. The first group of data is from older recordings from 1973 that Dr. David S. Rood shared with me. The second group consists of data from 2006 through 2009 field recordings in the Denver/Boulder area. In this section I briefly describe the recording and initial analysis procedures for each of these data groups.

2.2.2.1 Data from 1973 Narratives

The 1973 recordings were originally made on analog tapes.[1] The quality of these recordings is generally very good and free of noise. These recordings were transferred to a computer using a 44.1 kHz (16 bit) sampling rate . There are a total of 15 audio files that I considered for including in the database. Each audio file has approximately 10 to 15 minutes of recording that is in Lakota. From these, I chose five different files

[1] These recordings were done by Dr. Allan R. Taylor, from the University of Colorado, with assistance from Eli James.

to analyze. They represent five different speakers, all recorded in various places on the Lakota reservations in South Dakota. The choice to work with these five recordings was made based on recording quality and my attempt to sample different styles and types of speech. Although all five files have been annotated to some extent, only two of these are used for the analysis presented here. They represent one male speaker from Pine Ridge and one female speaker from Standing Rock.

The initial sentence level and broad glossing of this data was performed in *ELAN* (Sloejtes *et al.* 2009). Acoustic analysis of all the recordings was performed with *Praat* (Boersma & Weenink 2009), using an autocorrelation method to extract the fundamental frequency contour. Syllable and word boundaries were determined by examining the F0 pitch track along with the waveform, spectrogram, and intensity, as well as by auditory inspection. The coding of the words, syllables, tones, and prosodic breaks was all performed in Praat.

2.2.2.2 Data From 2006-2009

The second group of data is from one female Lakota speaker, Della Bad Wound, who has participated in various recording sessions during the past four years. Della performed different tasks in each of these sessions. The procedures for each recording varied as well. For the analysis here, I have used data from four different recording sessions.

The first piece of data I include is a recording of a Lakota narrative that was made in Boulder in February of 2006. The recording was made on a digital (Marantz) recorder using an external microphone. The sampling was done at 44.1 kHz (16 bit). The data was digitally transferred to a computer. The second piece of the data I use is from a field recording of a conversation between four Lakota speakers in the Denver area, in April of 2008. This recording was made using a high quality microphone and a digital interface device that fed the signal directly into a computer, at 44.1 kHz (16 bit) sampling rate. The entire recorded conversation is approximately 90 minutes in length. However, the audio quality for this data varies because

of wind noise and other overlapping influences from the environment. For the present study, I have only used a few phrases from Della Bad Wound's speech in this conversation. These phrases are sampled from different points in the recording.

The third and fourth pieces of data are based on two recording sessions with Della Bad Wound, performed in June of 2009. These recordings were made in a quiet sound booth, in the phonetics lab at the University of Colorado's Linguistics Department. The signal was directly sampled digitally and saved onto a computer. Backup recordings were made with a portable digital recorder as well. The first recording session in this data set consists of elicitations of isolated words and short phrases. The isolated word list is a small amount of data that is used for acoustic analysis of lexical stress (in section 3.2.2) and for analysis of intonational patterns of isolated words (section 3.3.3). The second recording session consists of several semi-spontaneous scripted conversations and a short autobiographical narrative.

The initial sentence level and broad glossing of the 2006-2009 data was performed in *ELAN* as well. Acoustic analysis of all the recordings was performed with *Praat*, using an autocorrelation method to extract the fundamental frequency contour. Syllable and word boundaries were all determined and coded in *Praat*.

2.3 Data Compilation and Extraction

2.3.1 Data Collection

In this section I describe in more detail the types of data that I compiled based on natural discourse and elicitations from each of the participants. Included are summaries of the tasks performed by the speakers, the size of the database, and what methods I used to obtain the kinds of data that would be useful for my analysis.

2.3.1.1 Tasks Performed by the Participants

The participants in this study performed varied tasks in the recordings. The tasks cover several genres, spanning natural and elicited speech. The parts of the 1973 recordings that I have used in this study consist of monologue or autobiographical narratives only. The recordings made between 2006 and 2009 cover all the genres represented in this dataset. Table 2.2 summarizes the information for each recording. The column labeled "Duration" specifies the temporal length of the portions of the narratives that were segmented and coded. The column labeled "# Phrases" is a count of the number of separate sentences that were coded during the broad transcription process.[2]

Speaker	Year	Task	Duration (min' sec")	# Phrases	Task Code
Sophie One Feather	1973	Autobiographical Narrative	3' 50"	112	N
Paul Red Star	1973	Narrative	7' 02"	244	N
Della Bad Wound	2006	Narrative	3' 02"	69	N
	2008	Conversation	(phrases only)	28	C
	2009	Elicitation: word list		91	WE
	2009	Elicitation: phrases		59	E
	2009	Scripted Phrases		42	S
	2009	Scripted Conversations		20	SC
	2009	Autobiographical Narrative	2' 33"	68	N

Table 2.2: The tasks performed by the Lakota speakers, during each specified recording. The column "Task Code" indicates the abbreviation used throughout this document to specify the task type for each piece of data. The codes are: N= narrative, E=elicitation, WE=word elicitation, S=scripted elicitation, SC=scripted conversation, C= conversation.

Several comments are in order. The elicitations, scripted phrases, and scripted conversation tasks are not labeled for duration. For these, the number of words or phrases is a better measure of the size of the dataset. The elicited word list consists of repetitions, but I have only listed types (not tokens) in table 2.2. Furthermore, for the actual analysis I only use subparts of the coded data shown in table 2.2. The criteria for what parts of the data to extract and use are described in section 2.3.2.

Narrative Genre

In the narrative tasks the speakers were asked to either tell a short story, relate something from their

[2] The number of phrases in table 2.2 does not represent the total number of intonational phrases in each data set. The criteria for segmenting the speech into intonational phrases were reached in the process of analysis itself.

childhood, or talk about certain events in Lakota. The SOF73 recording is an autobiographical narrative about events in Sophie's childhood. The PRS73 recording concerns the events that happened at Wounded Knee in 1973, which took place right before these recordings were made. The narrative recorded in 2006 is a re-telling of an older Lakota story called *Matȟówíŋ* ("Bear Woman"). The autobiographical narrative from 2009 is an informal discourse about where Della grew up and went to school, and what kinds of things she does these days. The phrases collected from the narrative genre contribute the bulk of the data for the analysis of the intonation and prosody of declarative utterances in Lakota.

Natural Conversation

The recording from 2008 is a natural conversation between four Lakota speakers. The entire recording is approximately 90 minutes in length. The speakers talked about various things, ranging from their childhood and their personal histories to the kinds of things they like to do these days. For this study I have only used a small portion of this data. This is partly due to the fact that segments of overlapped speech and environmental noise make the acoustic analysis of the phrases complicated. For the current study, I have carefully coded 28 phrases from Della Bad Wound's speech in this conversation. Of these 28 phrases, only a few have been incorporated into my analysis.

Elicitations

The elicitations consist of two inter-related parts. The first part of the task involved the repetition of isolated words from a list. This part of the elicitation is labeled with task code "WE" in table 2.2, indicating that the elicited items consist of isolated words. The second part of the task involved the production of longer phrases and sentences from a short list; this part is labeled with task code "E". The isolated word list was prepared and recorded in conjunction with the phrase elicitations. I drafted a list of items that included some of the lexical, syllabic, and sentence length distinctions I wanted to study. Before the recording, I spent some time consulting with Della about the nature of my study and the type of recording I needed. Della examined the drafted list of words and phrases one item at a time. Together we made several corrections, additions, and deletions. The final, edited list consisted of a total of 91 isolated Lakota words and phrases. We typed

the list into a tabular format, using an orthography that Della found comfortable for reading. During the subsequent recording sessions Della repeated each item on the list three times, on two separate days. I have used the isolated word list primarily in the analysis of the acoustic properties of lexical stress. The list of short phrases augments the declarative and interrogative data subset for the analysis of intonation.

Scripted Phrases

The 42 scripted phrases used in this study are based on contextualized, conversational style question-response exchanges. As in the word list elicitation, I had prepared a rough draft of some scripts for short conversations. I consulted with Della for additions and corrections before the recording was made. The final, edited list we prepared consisted of phrases embedded in very short, scripted conversations between two speakers. Next, we imagined several scenarios and, within those imagined contexts, we passed through the prepared list, exchanging question-response phrases. We took turns with the questions and responses so that Della's speech for both kinds of modalities was recorded. I also asked Della to re-do some of the scripts at different speech rates. The imagined contexts were originally aimed at obtaining data with different focus structures. Therefore, some of the sentences involve general predicate focus constructions, while others involve contexts for narrow focus. The narrow focus set consists of focus on subject, focus on object, focus on verb, and focus on modifiers and quantifiers. The phrases collected in this task provide material for both the declarative and the interrogative utterances analyzed in this study.

Scripted Conversations

The 20 phrases from the scripted conversation genre are based on longer scripts that Della and I created for a "role-play" style conversational exchange. In one task we imagined that we had gone for a walk in the morning and talked about what kinds of things we saw. The nouns, verbs, and other structures in the sentences were picked so as to obtain phrases with different numbers of stressed syllables and different numbers of intervening unstressed syllables; these phrases provide material for the analysis of the intonation of declarative and interrogative utterances. In the other task we imagined that there was going to be a dance that evening and we talked about who is going to participate in it. The sentences for this scripted

conversation task were picked so as to elicit different kinds of modalities such as negation, question, irrealis, and hearsay. These modalities are coded with enclitics in Lakota. The phrases collected here provide the data for the experiment on enclitics, discussed in Chapter 4.

2.3.1.2 Data Identification

The full codes for identification of individual data pieces discussed in the chapters are based on a) the speaker+year code from the abbreviation column in table 2.1 and b) a specification that indicates the genre of recording or the task that was performed by the speaker. These task code suffixes are separated from the speaker identification by a colon. As indicated earlier in table 2.2, the abbreviated task codes are N= narrative, E=elicitation, S=scripted elicitation, SC=scripted conversation, and C= conversation. Thus, a code such as [DBW09:SC] attached to an example specifies that the data piece comes from speaker Della Bad Wound, recorded in 2009 while performing the task of a scripted conversation.

2.3.2 Data Extraction Procedures

The raw data that was collected according to the tasks described in section 2.3.1 was subject to further filtering before it could be used for intonational analysis. Here I describe the general criteria I used for filtering the data.

From the narratives, only phrases that form clear intonational units are used for analysis. If a coded phrase has too many restarts, it is not included in the intonational analysis. Phrases that have overlapped speech or other overlapping noises are not included either. As already stated, from the natural conversational data between the four speakers only a small number of non-overlapped, clear utterances are included. Some of the elicited and scripted conversational tasks also resulted in phrases with long pauses and self-repair cutoffs. If the speaker paused and then re-did the sentence, then the new (un-paused) sentence is the only part that is included for analysis. If the speaker paused or did a self-repair cutoff and did not go back to the

beginning of the sentence, only the part *after* the cutoff is included for analysis. A few of the phrases in the elicitation tasks show a very compressed pitch range. These phrases are very difficult to analyze acoustically for F0 peaks, so they are excluded from the analysis database for this study.

Appendix A lists all the phrases, from all speakers and all tasks, which have been included for analysis in this dissertation. The tables displayed in Appendix A are arranged so that there is one table for each speaker plus genre, in accordance with the data reference codes described in section 2.3.1.2. For instance, table A.1 lists the subset of sentences from the 1973 narrative by Sofie One Feather (reference code "SOF73:N") that I have incorporated into the analysis. The tables consist of columns which display (a) values indicating the sentence number from the particular speaker-task, (b) the Lakota phrases, along with their free English translations, and (c) indications of sentence modality type (i.e., declarative, interrogative, quotative, and so on) for each phrase. I refer to the tables in Appendix A at various points throughout Chapters 3 and 4, when describing specific aspects of Lakota intonation and prosody. In each part of the description I specify which subset of the database represented in Appendix A was used for the particular analysis.

2.4 Transcription: Segments and Syllables in Lakota

In this section I outline several segmental and syllabic features of Lakota. This is necessary in order to justify the conventions used in the orthographic and syllabic tiers in the data annotation. An understanding of Lakota segmental and syllabic structure also helps make sense of some of the difficulties encountered in the acoustic analysis of intonation.

2.4.1 Segmental Features

There are either 26 or 28 consonants in Lakota, depending on whether the two voiced stops [b] and [g] are counted as phonemes. These two stops show a very restricted distribution in the language (Rood & Taylor 1996:442). In agreement with the New Lakota dictionary (Ullrich 2008), I treat [b] and [g] as

phonemes. Table 2.3 lists all the consonants, organized according to the place and manner of articulation. Phonemically, Lakota has five oral vowels and three nasal vowels. The nasalized versions exist only for the highest and the lowest vowels. The vowels are listed table 2.4, organized in terms of height and backness. The phoneme symbols in tables 2.3 and 2.4 also display the orthography that I have used for transcribing the Lakota phrases. The adopted writing system is based on the "Standard Lakota Orthography" used in the New Lakota Dictionary.

I do not elaborate here on the specific aspects of the pronunciation of each phoneme. The phonology section in Ullrich (2008:693-700) lists the typical pronunciation values and describes the degree of variation observed in some of these sounds. The New Lakota Dictionary also provides a website where one can listen to the actual pronunciation of these phonemes in real speech. The five Lakota oral vowels are typically pronounced like the five cardinal vowels. Figure 2.1, displayed after the phoneme tables, shows a scatter plot of the Lakota oral vowel space for speaker DBW. The points in the plot correspond to formant values extracted from the mid-portion of vowels in isolated word repetitions.

Lakota Consonants		labial	dental	palatal	velar	post-velar	glottal
Obstruents							
stops	plain (voiceless)	p	t	č	k		’
	aspirated glottal	ph	th	čh	kh		
	aspirated velar	pȟ	tȟ		kȟ		
	glottalized	p’	t’	č’	k’		
	voiced	b			g		
fricatives	plain (voiceless)		s	š		ȟ	
	voiced		z	ž		ǧ	
Resonants							
	nasals	m	n			ŋ	
	laterals		l				
Glides							
		w		y			

Table 2.3: Lakota consonant phonemes.

	front	mid	back
high	i		u
		iŋ	uŋ
mid	e		o
		aŋ	
low		a	

Table 2.4: Lakota vowels phonemes.

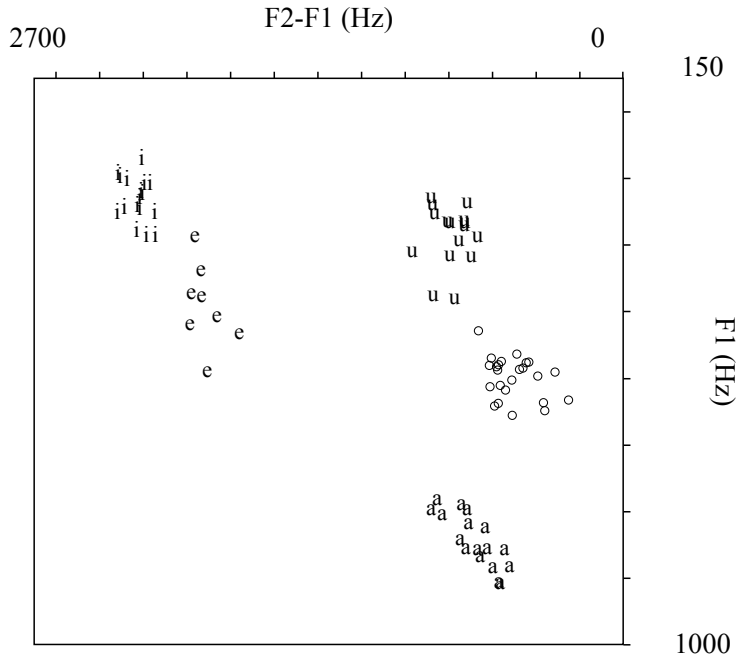


Figure 2.1: Lakota Oral Vowel Formants (F1 versus F2-F1 plot). The individual data points are based on formants of the oral vowels sampled from word-medial position. The vowel segments were extracted from isolated word elicitations. Data from DBW09:E.

2.4.2 Syllable Structure

The C and V phonemes are combined into words according to rules and constraints. Generally, Lakota words begin with one or two consonants and end in a vowel. However, there are words that start with vowels and (not very frequently) words that end with one consonant. The consonants that can end a word are /l/, /n/, /m/, /b/, or /g/. In previous studies it is generally agreed that Lakota allows for consonant-final stems in the underlying forms of words, but that most nouns and verbs require a so called stem-formation rule that puts in a final vowel (Patterson 1990:62). The maximum underlying syllable in Lakota is thus CCVC. The consonants permitted in the onset position and the coda position have further restrictions.

Not all syllables in Lakota take the maximal CCVC structure. Frequently, there are syllables of the forms V, CV, CCV, or CVC. The vowel is the nucleus for purposes of syllabic organization. Syllabic junctures, however, are not always easy to label. Certain Lakota words contain a sequence of identical vowels (VV); in such cases it is not always clear if a syllable break comes between the vowels (V.V) or if the vowels are pronounced as single, long vowel (V:). Also, in some words a sequence of two consonants occurs between two vowels (i.e., the word is formed with a CVCCV sequence). It is not always clear whether the syllable break is CV.CCV or CVC.CV. In such contexts, the morphological makeup of the word sometimes, but not always, clarifies the syllabification. The pattern seems to be such that the syllabification respects the morpheme boundaries.

2.5 Coding Intonational Events: adaptation of ToBI

2.5.1 Phonetic Analysis of Intonation

In the process of transcribing and analyzing the collected data I make extensive use of the fundamental frequency (F0) contour as the phonetic representation of intonation. The choice of the F0 representation, as opposed to other possible phonetic representations, is both theoretically and practically motivated. In this

section I discuss some of the reasons for choosing the F0 variable - as opposed to some other observable - as a phonetic representation of intonational patterns.

2.5.1.1 Concerning the F0 Contour

The F0 contour is the acoustic component of tonal events and transitions in speech. In terms of the anatomy of sound production, the F0 contour is a representation of the rate of vibration of the vocal folds. F0 values can be generated for segments of speech and represented as pitch tracks. These pitch tracks are estimations of the rate of vocal fold vibration, based on an acoustic analysis of speech that uses spectral techniques to extract the fundamental frequency components out of complex waveforms.

The F0 contour of an utterance by itself does not provide useful information for analyzing intonation from a linguistic perspective. Using acoustic data to analyze linguistic properties of intonation involves several stages of transcription. In addition to the extracted F0 contours, a fairly detailed transcription of the phrases, words, and syllables in the utterance is needed. When the F0 contour of the utterance is aligned with these "segmental" transcription tiers, regularities of F0 events (such as pitch peaks, plateaus, or transitions) relative to the segmental material often emerge. For example, Bishop (2003) analyzes the intonation of Bininj Gun-Wok by first extracting F0 contours and annotating the data with various transcription tiers. Subsequent alignment and parallel analysis of these components allows Bishop to see regularities that provide information about the intonational structure of the language.

There are, however, several complications with this kind of analysis. The patterns one finds in the alignments are sometimes intonational in a phonological sense. However, the F0 contour frequently carries phonetic information that, although interesting in its own way, may not be significant for analyzing tones in a language. Therefore, the F0 contour analysis has to be complemented by auditory and perceptual judgements in order to uncover the relevant patterns of intonation and prosody.

2.5.1.2 Other Observables for Intonation

Phonetic parameters other than the F0 contour can be used to describe intonation. One could start with an articulatory, gestural, motor-control analysis which tries to model intonational events and transitions in terms of laryngeal muscle control. Although such a model would be very appealing, the articulatory details of vocal fold control are generally difficult to model. Previous studies on intonation, such as Pierrehumbert (1980), Clark & Yallop (1990), and Bishop (2003), have highlighted the difficulties involved in gestural models of intonation. The articulatory component of tone production is perhaps the underlying physical mechanism responsible for many of the patterns seen in the F0 contour. For instance, F0 contour turning points may be be traceable to some type of command that controls the complex laryngeal muscle gestures that determine the rate of vibration of the vocal folds. This kind of detail is complicated to extract from speech forms.

It can also be argued that one should use a more linguistic approach to intonation. For instance, one could start by trying to correlate impressionistic intonational patterns with meaning and context. There are, however, several problems with this type of approach. One of the main complications with such an analysis is that it is not clear if semantic or pragmatic units are a good starting point for studying intonation. Prosodic characteristics generally do not line up with pragmatic categories in a simple way. A second complication is that much of the work along this line requires an already existing basic understanding of the types of tonal entities and the suprasegmental prosodic structure in the language. Since this study is the first exploration into Lakota intonation and prosody, it is not clear if pragmatic and semantic units will provide an advantage at the outset. However, it is important to keep in mind that pragmatic information generally interacts with the intonational system of a language. At various points in this study, for instance, the pragmatic notion of "focus" becomes relevant (see, for example, section 3.5.3 on intonational characteristics of interrogatives in Lakota).

2.5.1.3 F0 as the Phonetic Representation of Intonation

Given the above consideration and complications, I have chosen to use phonetic and phonological methods for quantifying intonation and prosodic phrasing in Lakota. I adopt the view that the F0 contour is a useful way to look at intonation for the following reasons. First, F0 contours are simple to extract and are "the most accessible data which are relevant to a quantitative description of intonation" (Pierrehumbert 1980:3). Second, acoustic data of this form - subject to the perceptual constraints mentioned earlier - provides a first order bridge between what the speaker produces and what the hearer perceives. Third, the F0 contour provides a good starting point for analyzing the tonal and prosodic phenomena in a language whose intonation is not well understood. Fourth, the use of the F0 contour as a representation for intonation is also in line with, and thus comparable to, previous studies of intonation in other languages. These include Pierrehumbert (1980), Jun (1993), Bishop (2003), Gordon (2005), and others.

2.5.2 Choice of Transcription System for Intonation

In this section I describe the foundations of the intonational transcription system that I use in my analysis. First, I give a brief introduction to the available methodologies for transcribing intonation and prosodic breaks. Then I introduce the general features of the ToBI transcription system. I outline the way in which the ToBI system is fit for transcribing intonational characteristics of Lakota.

2.5.2.1 Overview of Transcription Systems for Intonation

One of the first methodological questions in the study of intonational systems is how to annotate and transcribe the tonal and prosodic patterns of a language in a meaningful way. Segment-level phonemic transcriptions of vowels and consonants - either at an impressionistic level or a detailed phonetic level - have been developed extensively. Many languages with written forms have a phonemic transcription system (i.e., an alphabet) in place which marks all the paradigmatic sound distinctions in the language. Although the

details are disputed amongst different scholars, phonemic transcription systems are available for Lakota, as discussed in section 2.4. However, in the realm of larger suprasegmental structures - which include aspects of speech such as intonation, prosodic phrasing, and duration - most languages do not employ a systematic "writing system". Generally, languages have systematic orthographic symbols for marking things like lexical accent, lexical tone, and phonemic vowel length. Utterance and discourse level chunks such as surprise statements, questions, and pauses are sometimes marked in the orthography of a language, but at a very impressionistic level. Certain languages mark some of these utterance scale distinctions with morphology, so there may be no need for any explicit transcription of the events in such cases. In either case however, there is generally no well developed, detailed, symbolic transcription in the orthography of languages that marks things like levels of prosodic phrasing, late peak alignment, or specific boundary tone phenomena.

From a linguist's perspective, research on intonation and prosody is at an early stage of development compared to phonemic and segmental phonology. This means that the equivalent of an international phonetic alphabet is not available, even if such a thing could be developed for intonation. Within the last thirty years a number of systems for transcription of intonation and prosodic boundaries have been developed for various languages. What one finds from examining these transcription systems is that each method has been shaped by the language for which it was made. The transcriptions have also been influenced by the goals of the person, group, or team that developed the system. The most recent, well known, and widely used transcription systems for intonation are 1) IPO, Institute for Perception Research at Eindhoven ('t Hart *et al.* 1990), 2) ToBI, Tones and Break Indices (Beckman & Elam 1997) and 3) INTSINT, INternational Transcription System for Intonation (Hirst & Cristo 1998).

All of these transcription systems aim to annotate F0 targets or movements at selected, significant, points in the F0 contour. The ToBI and INTSINT systems label level F0 targets in the contour. The IPO annotations label sequences of tone targets, such as rises and falls, which capture F0 movements along with information about the alignment, rate, and magnitude of F0 variations. In the following few sections I describe the fundamental elements of the ToBI transcription system that I adopt for annotation of Lakota

intonation. One of the reasons for using ToBI is that it was developed within the theoretical framework of an AM phonology of intonation. A second point in favor of ToBI is that it is the transcription system with the most robust method of delimiting prosodic boundaries by the use of "break indices" (described below, in subsection 2.5.2.4).

2.5.2.2 ToBI and the AM Framework for Intonation

The core motivation of the ToBI transcription system is to capture a way of marking intonational events that are consistent with the constraints of the AM theory as applied to intonation. As mentioned earlier, in section 1.3, the AM theory provides a framework for tonal and prosodic analysis that is phonological, yet phonetically accountable. A transcription system that is based on this model must therefore a) label quantized phonological events, b) provide a way of quantifying prosodic boundaries, and c) have some kind of a system for indicating the scaling of tonal targets.

ToBI transcriptions for an utterance minimally consist of a recording of the speech, an associated electronic record of the F0 contour, and symbolic transcription labels arranged in four tiers. The four tiers of labels are (i) an orthographic segment/word transcription tier, (ii) a tone transcription tier, (iii) a break index tier and (iv) a miscellaneous/comment tier. More tiers can be added for particular needs.

The tone and break index tiers represent the core components of the intonational and prosodic analysis. The tone tier is a phonological representation of the intonational pattern while the break index tier marks the perceived, listener-judged, level of prosodic juncture between adjacent "words" in an utterance. The prosodic juncture values are based on judgements of the degree of association, or disassociation, between nearby items. The orthographic and phonetic transcription tiers are not directly part of the prosodic analysis. However, they are extremely relevant for analysis of the interface between the tonal phenomena and the segmental tier. The specifications for the orthographic and phonetic tiers are not very different from phonemic (or IPA) segmental transcriptions. The orthographic tier contains labels for lexical stress, which is part of the

dictionary or grammar entry of words. The events transcribed in the tone tier can then be analyzed relative to the orthographic tier to examine how they associate and align with lexically stressed syllables. Furthermore, a phonetic transcription tier can label certain details, such as creaky phonation or final lengthening. These can then be analyzed in parallel with the break index tier to reveal information about phonetic and phonological processes that take place at different junctures.

The miscellaneous tier in ToBI can include types of information that are not necessarily prosodic, but are important for interpreting the analyses of the tone and break index tiers. This tier could include labels for events that disrupt the smooth rhythm of speech, such as initiation of self-repair or some other induced interruption of the intonation.

2.5.2.3 Tonal Transcripts in ToBI: The Tone Tier

The tone tier consists of labels for distinctive pitch events in the in F0 contour. Two level tones are labelled: H and L. Individual pitch-accents can be mono-tonal (H or L), bitonal (HL, LH), more potentially multi-tonal (LHL, HLH, etc. ...). Diacritics placed by the level tone labels are used to indicate various kinds of associations and relationships between the tones and between tones various prosodic units (such as syllables, words, etc...). The tones are orthographically aligned with the syllable with which they are associated.

The star diacritic, *, denotes a tone that is generally associated with a lexically accented syllable (if such syllables exist in the language). The addition symbol, +, can be used in bitonal accents to indicate that a tone forms a phonological unit (a "tone syllable") with a preceding or following starred tone. A hyphen, -, is used to mark the association of a tone to a prosodic phrase boundary that is smaller than the intonational phrase. A percentage sign, %, is used with tones which are associated with the boundary of the larger intonational phrase.

Tones are also labelled for their scaling relationships, indicating whether they are downstepped (a tone

lowered with respect to an immediately preceding pitch accent) or upstepped (a tone raised with respect to an immediately preceding pitch accent). Downstep is annotated by the use of a diacritic ! before the tone label H (i.e., !H). Upstep is annotated by the use of the diacritic ˆ before the tone (i.e., ˆ H).

One important question in ToBI transcriptions is how to, simultaneously, annotate the time-alignment of tonal events with respect to the F0 contour and the segmental tier. The starred, core tones are generally transcribed in such a way that they are time-aligned with respect to F0 events (turning points, plateaus, or elbows). These events are, generally, within the temporal boundaries of the metrically strong, lexically stressed, syllable. However, it is possible that significant turning points come early or late with respect to the temporal boundaries of the stressed syllable. The transcription alignment runs into problems in such cases. ToBI adopts two pointer diacritics in the tonal transcript to indicate the horizontal mis-alignment of the tonal event with respect to the stressed syllables. The label < placed after a tone label (for example, H*<) indicates that the F0 turning point is realized after the utterance of the lexically stressed syllable; cases such as these are called *late alignment*. The label > placed before the tone mark (i.e., >H*) indicates that the F0 turning point is realized before the utterance of the lexically stressed syllable; these are called *early alignment*.

The types of prosodic units that tones can associate with generally vary from language to language. Thus, the system of diacritics needs to be varied or expanded to accommodate language specific needs. For instance, more detailed labels for coding *pitch range* may be needed in some contexts. In section 2.5.3 I discuss several modifications that I have made to this system in order to adapt the ToBI labeling for Lakota.

2.5.2.4 The Break Index Transcript in ToBI

The break index tier in the ToBI transcription system is an attempt to provide an impressionistic measure of the perceived prosodic association/disassociation of adjacent words. It is important to realize that the kind of togetherness coded by the ToBI break indices system is phonetic and/or phonological. It

does not necessarily imply syntactic, semantic, or discourse-level grouping of adjacent units. The syntactic, semantic, and discourse constituency may correlate with these prosodic units, but there is no reason to assume, a priori, that they should (see discussion in section 1.4.4). While coding the Lakota data with break indices I have adopted the view - incorporated into ToBI and extensively discussed in Ladd (2009) - that marking prosodic boundaries should be considered as a phonetic and phonological exercise.

In the ToBI transcriptions for English, five levels of juncture between adjacent words are coded numerically. Values for the break index are chosen from the following set (Beckman & Elam 1997).

- BI=0: Used for cases of clear phonetic marks which indicate that two words have "attached" together.
- BI=1: Used for most phrase-medial "expected" word boundaries.
- BI= 2: Indicates a juncture between adjacent words that is either a) marked by a pause, but with no tonal marks, or b) tonally marked as a boundary, but with no pauses or lengthening.
- BI=3: Marks the intermediate intonation phrase boundary (see sections 1.3.1 and 1.4.3).
- BI=4: Juncture level used for a full intonation phrase boundary which is marked by a final boundary tone (labeled with L% or H%).

Of the five levels shown, note that break index value 2 is reserved for places where there appear to be mismatches between the perception of the juncture and the tonal cues for the juncture. Hearer perception of junctures in prosodic units probably depends on a complex system of acoustic and structural cues. Acoustic cues influencing the perception may include things like F0 tonal properties, durational properties such as lengthening, or segmental information such as full versus reduced pronunciation of vowels and consonants localized at the prosodic junctures. The structural properties influencing the perception may involve contextually strong and weak relationships between different parts, or global F0 variation between the prosodic units.

2.5.2.5 Coding Uncertainties in Tones and Boundaries

The ToBI transcription system also describes some basic conventions for handling annotation uncertainties that may arise for various reasons. There are situations when the transcriber is certain that there is a tone at a particular point, but he or she is uncertain about the particular type of tone. For example, the F0 track might have had problems or perceptually it may be unclear what the exact tone is. In these instances the transcription X*? is used to mark the clear presence of a pitch-accent, without arbitrarily committing to a particular tone type. This system is extended for marking ambiguities of boundary tones as well. One can use X%? to indicate the presence of a boundary tone, without committing to the particular type of tone.

Furthermore, there may be cases when the transcriber is uncertain whether there is a pitch-accent at a particular point in the F0 contour. In such situations the notation *? is used to indicate the uncertainty. Likewise, a %? transcription can be used to indicate that the transcriber is not certain if there is even a boundary. These situations can arise when there are many conflicting phonetic and perceptual observations which make the judgement of a tone or a boundary difficult.

These marking conventions handle some of the problems that arise in the process of transcription. However, there may be more fundamental problems which are harder to handle in the ToBI transcription convention. I discuss these difficulties briefly in the discussion in section 2.6.

2.5.3 Adaptation of ToBI for Lakota

One of the outcomes of the analysis of Lakota intonational structure is the formulation of a model for transcribing the linguistically relevant aspects of tone and prosody in the language. As I have already indicated, the transcription method I have developed is based on the tones and break indices used in the ToBI system. Applying the ToBI transcription to a new language involves establishing a system through the process of transcription itself. I started the development of a tonal transcription system for Lakota by first carrying out a small-scale pilot study with isolated words. This pilot study, along with impressionistic

observations of phrases, helped establish a rudimentary transcription system. Through the process of analysis of the data described in section 2.3, the transcription system has evolved and changed in several ways.

In this section I present the current version of the ToBI style transcription that I use for coding tonal events and juncture values in Lakota phrases. I have named this coding system LaToBI. This system minimally consists of six tiers of representation. These tiers are as follows.

- Sentence tier: a broad transcription of the Lakota utterance
- Gloss tier: a translation of the Lakota utterance in the sentence tier into English
- Tonal tier: a point tier used for time labeling significant intonational events in the phrase
- Break Index tier: a point tier for marking the perceived level of juncture between adjacent words
- Word tier: an orthographic transcription tier for marking the boundaries of Lakota words
- Syllable tier: a phonetic marking of syllable boundaries within each word in the phrase

The tiers in LaToBI are similar to those used in ToBI for English. However, note that I have incorporated both a Word tier and a Syllable tier in the LaToBI transcription. The Word tier is a phonemic transcription of the data, while the Syllable tier represents a phonetic transcription in which inserted glottal stops, lengthening, and other types of phonetic effects are transcribed. The Syllable tier is also useful for a more precise analysis of the exact *alignment* of tonal events relative to the segmental material. The labeling of the data is first carried out by auditory judgement. Subsequently, more precise locations and boundaries of temporal events are identified by consulting the waveforms and the associated autocorrelation F0 contours, spectrograms, and intensity graphs. The waveform, spectral, and intensity plots are primarily used to clarify syllable and segment boundaries. In what follows I outline the categories and conventions that I use for coding information in each of the above mentioned tiers.

2.5.3.1 The Sentence and Gloss Tiers

The sentence tier is the first stage of symbolic transcription of the data. The waveform of the speech is segmented into utterances which, at least based on impression, consist of at least one intonational phrase. Each Lakota utterance is then transcribed orthographically. In my transcriptions, I have adopted the orthography used in the New Lakota Dictionary (Ullrich 2008:694), as described in section 2.4.1. The sentence tier is a broad phonemic transcription that does not specify things like phonological and phonetic alterations at word boundaries. The gloss tier accompanies the sentence tier. It also has the same temporal boundaries as the sentence tier. The material in the gloss tier is a broad translation of the entire Lakota sentence.

2.5.3.2 The Tonal Tier in LaToBI

The tonal tier in LaToBI is generally the same as the original ToBI tone tier, described in section 2.5.2.3. High (H) and low (L) tones are marked at specific, time-aligned, points relative to the segmental transcriptions. The decision to mark a tone at a specific point is based on perception and reference to the F0 track.

Marking Pitch Accents

Just as in the original ToBI system, a pitch accent event is indicated by the * diacritic placed after the tonal mark. Thus, the symbol H* represents a simple, high pitch accent. Unlike the original ToBI system, I have not used the addition symbol, +, to mark bitonal pitch accents. Complex pitch accents, if present, are written as LH* or H*L. I have also dispensed with the original ToBI hyphen marking in pitch accents.[3]

Marking Edges

I use the % symbol to mark tones that are associated with the boundary of the larger intonational phrase. However, unlike the original ToBI, I have not used a hyphen symbol, -, to mark phrase accents. Since at

[3] These choices are not unique to LaToBI. Some other transcription systems, such as TODI for Dutch (Gussenhoven *et al.* 2003), mark bitonal pitch accents without the + symbol.

the start of the analysis it was not clear if Lakota had phrase accents, the decision to omit the hyphen symbol was made to keep the annotations as simple as possible. The final results of the analysis indicate that phrase-accent-like events do actually exist in Lakota. The way that phrase accents surface in the F0 contour makes it hard to transcribe these without reference to information in the break index transcriptions (see section 2.5.3.3 below). In the current version of the transcriptions, I have relied on the break index system to indicate the presence or absence of phrase accents. The reason for this choice will become clearer as the analysis unfolds. Whether a special tonal-tier marking is used for phrase accents is partly a theoretical decision, which I discuss in Chapter 4.

Additional Diacritics

I have adopted the ToBI extra diacritics for marking scaling and alignment of tones. As described in section 2.5.2.3, downstep is trancribed using the diacritic ! before the tone label H (i.e., !H). Tonal upstep is annotated with the diacritic ˆ before the tone (i.e., ˆ H). In terms of time alignment, the label < placed after a tone label (for example, H*<) indicates that a peak is late relative to the stressed syllable. The label > placed before the tone mark (i.e., >H*) indicates that a peak is early relative to the stressed syllable. I have also adopted the diacritics for marking uncertainties. In LaToBI, *? implies uncertainty about the presence of a pitch accent and X*? implies uncertainty about the accent type. The same uncertainty diacritics are used with the boundary marking % to indicate ambiguities of edge tones.

2.5.3.3 The Break-Index Tier in LaToBI

BI=-1

The lowest break index I use in the transcription of word junctures in Lakota is -1. This value marks a very close juncture between adjacent words. The level of union between adjacent units constitutes a "negative" juncture when it involves the deletion of expected phonetic material.[4] In my transcriptions, therefore, I use the -1 break index to label (a) morphosyntactic word boundaries that are either phonetically blurred/elided

[4] The traditional English ToBI value for this type of juncture is 0.

or (b) positions where expected word boundaries are perceived as shifted around. If clear word boundaries can be identified perceptually then I do not use -1 juncture value.

BI=0

Break index 0 is the expected, default, level of juncture. When two morphosyntactic words within an intonational phrase are pronounced in such a way that I hear the initial and final segments distinctly, I mark them with a level 0 juncture value.

BI=2

Break index 2 is a label for the right edge of a unit of speech that is larger than a morphosyntactic word, but smaller than the entire intonational phrase. In general, there is at least one - but possibly two or three - somewhat major pitch accents in each such labeled unit. In the usual cases, there are at least two phonetic cues associated with BI=2 juncture. The first cue is a tonal one. At the right boundary of a unit marked by value 2 there is either a flat stretch of tone that extends over several syllables, or there is a slightly raised or rising tonal sequence. Before the end of the intonational phrase these tonal movements link the last pitch accent to the final boundary tone. In the middle of an intonational phrase these tonal movements span several syllables and appear to link pitch accents together. The second cue associated with the right boundary of the BI=2 juncture is related to tempo and/or duration. Sometimes, in addition to the tonal cue, there is a lengthening of word final vowels *without* a final drop to the bottom of the speaker's range. At other times there is a slight slowing of tempo or the feeling of a hesitation.

BI=3

I used break index value 3 to mark a large intonational phrase (IP) juncture. At this level of juncture several things usually happen. The speaker generally reaches the bottom of the pitch range, sometimes even producing a creaky voice. After this juncture there is a pitch reset to a mid or high level that starts the next intonational phrase. Sometimes there is an optional lengthening of the final (vocalic) segment. In declarative utterances in Lakota there is sometimes a final glottal stop that co-occurs with this boundary. Some, or possibly all, of these phonetic cues are used perceptually for identifying BI=3 juncture.

BI=1

Break index value 1 is defined relative to the other indices described above. I use BI=1 to indicate that either there exists only one type of correlate for the boundary being marked, or that there are mismatches between the various phonetic cues for junctures. For instance, there are cases in the data where there is a clear tonal correlate to a phrase boundary, but this tonal cue is not accompanied by any other indication of a juncture. In such a situation I mark the juncture with BI=1. On the other hand, there are cases when there is lengthening or a hesitation, but there is no clear tonal cue to a phrase boundary. Again, I use BI=1 in such circumstances.

Break Index Diacritics

In addition to the basic break values, I use two diacritics to indicate significant phonetic events that happen frequently at word and phrase boundaries in Lakota. One of these phonetic events is the insertion of a glottal stop between words when the second word in the sequence starts with a vowel. I label the break index value with an additional letter "g" to indicate the presence of this kind of glottalization. Thus, [BI=0g] indicates that two adjacent words are pronounced as two distinct words and that, in addition, there is a glottal stop inserted in between these. The second phonetic event coded is prosodic, related to the occasional insertion of a hesitation or a short pause between words in phrases. I mark these hesitations by adding a diacritic "p" to the BI value. Therefore, [BI=2p] indicates that there is a tonal correlate for a phrase boundary that is accompanied by lengthening and tempo, and, in addition, there is a hesitation or a pause after the offset of the last word in the phrase.

"In-Between" Break Indices

In some occasions the phonetically observable correlates for word boundaries are in harmony with each other, but they are slightly at odds with the observer's intuitive, perceptual feeling of boundary strength between adjacent words. For example, in unmarked (i.e., "expected") word boundary situations, two adjacent words generally display neither any overt phonetic blending of boundaries, nor any of the tonal or durational cues in favor of an extremely strong boundary. The ToBI conventions outlined above imply that the value

of the boundary strength at such a juncture should be BI=0. However, in actual practice, there may be extremely subtle tempo or durational cues at word boundaries which one hears, but which are difficult to display or measure in any simple manner. Such cues may cause two adjacent words to sound ever so slightly co-articulated. Under such circumstances, I annotate the break index value at the word boundaries with an additional negative diacritic symbol to indicate that the juncture is just slightly weaker than the "expected" standard value. The break index symbol I use at these "slightly-weakened-but-unmarked" word junctures is BI=0-. By definition, the negative diacritic can only apply to break index values 0, 1, or 2.

2.5.3.4 The Word Tier

In order for tones and break indices to be useful for analysis, these need to be correlated with words in the Lakota utterances. The word tier takes the sentence tier and carefully marks all the clear boundaries between words. As in the sentence tier, I use the Ullrich (2008) orthography to write the Lakota words. Words are transcribed with boundaries that are time linked to the waveform. I use a spectrogram to facilitate the location of word boundaries when there are ambiguities.[5]

In addition, I use the [=] sign in the word tier to symbolically mark the boundaries between compound words, and between major category words and enclitics. The majority of the enclitics in Lakota occur with verbs in sentence final position. Some of the enclitics show a close association with the head word, while others are more loosely glued. If, perceptually, an enclitic is pronounced as glued to the head word then I attach it to the head word with the [=] sign in the transcription. If an enclitic is saliently pronounced as apart from the head word, I transcribe it as a separate word in the word tier, but still prefixed with [=] sign to indicate that is is a semi-dependent linguistic item.

[5] I should mention that the idea of the "word" as a unit of analysis is often difficult to define. I discuss the concept of a word for Lakota in Chapter 4, section 4.2.

2.5.3.5 The Syllable Tier

LaToBI always includes a syllable tier because the information coded in this level of representation is very important to the question of tonal alignment and word boundaries. Since Lakota morphological words can consist of prefixes, suffixes, enclitics, and word-word compounds, they tend to be polysyllabic. The syllable tier is useful in locating exactly where the significant pitch events occur within these longer words. The syllable tier also highlights morphemes and boundaries that are more prone to phonetic and phonological processes involving lengthening and elision.

2.5.3.6 Additional Optional Tiers

There are two optional tiers in LaToBI. One of these is the standard optional tier, used in the original ToBI to note various factors that may disrupt the flow of the speech signal or pitch track. Self-repair initiations, other-repair initiations, periods of silence, and other important conversational factors that temporarily stop the flow of speech are marked on this tier.

The other tier that I provisionally call optional is a pitch range tier. In the process of analyzing the corpus of data I realized that there are locations in Lakota intonational phrases where significant pitch range events take place. Some of these pitch range events are distinct from the downstep and upstep events. The events coded on the pitch range tier involve sudden changes in pitch span, as well as the onset of extremely compressed pitch ranges that last across several words. Various parts of the collected data discussed in section 2.3.1 have been extensively coded with a pitch range tier. In addition to downstep [!] and upstep [ˆ], I have coded four additional pitch range events on the pitch range tier according to the following conventions.[6] The label [PSC] marks the sudden compression of pitch span. By contrast, [PSE] marks the sudden expansion of pitch span. The label [HPL] marks the start of a high pitch level that is sustained for large portion of an intonational phrase. The label [CPR] marks the start of a compressed pitch range that lasts throughout

[6] I should clarify that downstep and upstep are doubly coded for the parts of the data that are marked for pitch range events. That is, downstep and upstep diacritics are marked both on the tonal tier and on the pitch range tier.

a large portion of an intonational phrase. An [=] sign is used in the pitch range tier to indicate that the coded pitch range and tonal patterns continue across a pause in the middle of an intonational phrase. When more than one pitch range event applies at a given point, the diacritics for the different events are linked together with the [+] symbol. Thus, if downstep applies and, simultaneously, the pitch span is dramatically compressed, the code [!+PSC] is used in the pitch range tier. The analysis or significance of the pitch range events remains incomplete at this time.

2.5.3.7 Summary of LaToBI

The study presented here uses the LaToBI tier system outlined above for coding intonational characteristics of Lakota. This system is an adaptation of the ToBI conventions for labeling intonational and prosodic information. The data for the current study has been annotated with eight maximal tiers of representation. Figure 2.2, corresponding to example (3), illustrates the tiers and conventions of the LaToBI scheme. All eight tiers of coding are shown, along with the F0 pitch track and the waveform. The figure also illustrates several aspects of the tonal and break index conventions and diacritics discussed earlier.

(3) máške ób šna , líla šna ób omá-wa-ni

friend with$_{PP.pl}$ often$_{ADV}$ very often$_{ADV}$ with$_{PP.pl}$ 1.sg.agt$_{infix}$-travel around

"Often with my friends, very often I travel around with them." [Speaker DBW09:N]

The samples of data discussed in Chapters 3 and 4 are presented visually in the format shown in figure 2.2. Generally, I do not print the sentence, gloss, pitch range, and miscellaneous tiers in the figure unless needed. The Lakota sentence with its morpheme gloss and English translation are usually shown above the figure, as in example (3).[7]

[7] A ToBI-style analysis traditionally includes an inventory of the tones that are used in the language under investigation. Since the discovery of the types of pitch accents and edge tones in Lakota is one of the main components of this study, I have not included an inventory of tones in my outline of LaToBI in this section. I provide the inventory of Lakota pitch accents and edge tones in section 3.3.5 (page 116), after presenting the analysis of the tonal patterns.

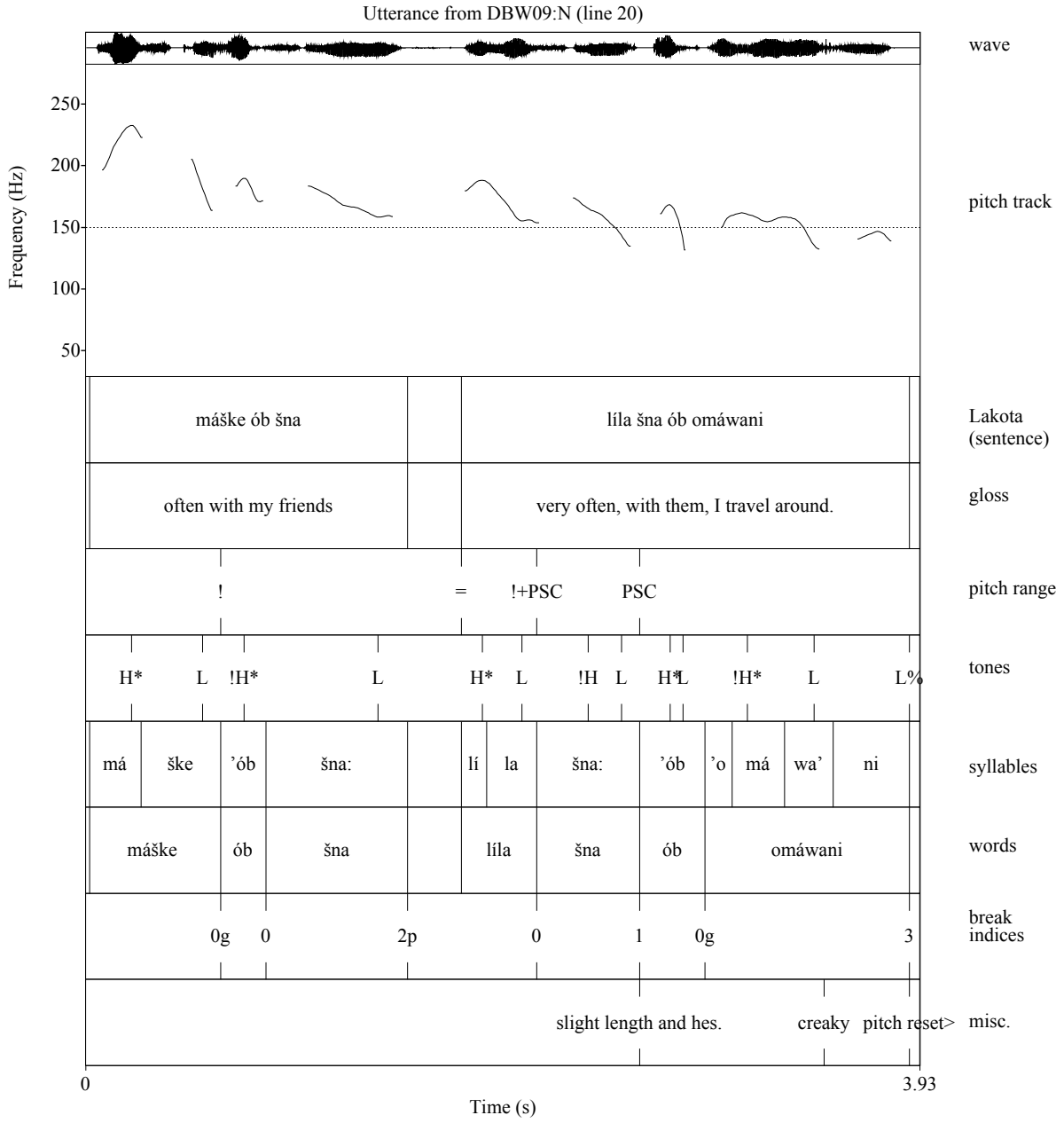


Figure 2.2: The maximal LaToBI annotation uses eight tiers of coding, along with a visual representation of the pitch track and the waveform. The utterance displayed corresponds to example (3).

2.6 Analytical Problems with Methodology

The methodology presented in this chapter is not without problems. There are several analytical complications that arise in the process of coding the data. In this section I briefly address some of the issues concerning the tonal and prosodic analysis.

2.6.1 Identification of Tonal Events

The first analytical problem concerns the question of identification of significant tonal events in the F0 contour. Namely, how does one decide what constitutes a "significant tonal event"? Once a tonal event has been identified, there are several decisions and assumptions concerning its transcription.

A phonetic issue that frequently augments the tonal identification problem is the interactions between the segmental and the suprasegmental observables. Some of the previously observed patterns of perturbation are the following (Hombert 1978).

- Voiceless segments insert gaps in the F0 contour and raise the onset F0 value of a following vowel.
- Voiced consonants lower the onset F0 value of a following vowel.
- Voiced and glottalized obstruents cause sharp dips and rises in the F0 contour.
- Vowels have an intrinsic pitch which correlates with vowel height; higher vowels have higher pitch.

Lakota has a wide array of voiceless consonants (see table 2.3) which cut off the continuity of the F0 contour and cause perturbations in the intrinsic pitch of nearby vowels. The patterns I have observed generally agree with Hombert's observations outlined above. Lakota voiceless stops in syllable onset position increase the onset F0 target of the following vowel (see section 3.2.2 in Chapter 3 for details). There are also ejective and glottal stop sounds in Lakota that cause dips in the onset F0 values of the nearby vowels. These

segmental effects complicate the intonational analysis in the majority of the phrases collected in natural speech. Through the process of annotation of many phrases, however, cues can be discovered that help disambiguate the pitch accent tone from the segmental phonetic effects. However, in some utterances, and especially in compressed pitch ranges, the interference of consonantal perturbations is heavy. The parts of the data that have such severe interference are not used for the intonational analysis.

2.6.2 Marking Prosodic Boundaries

The second analytical issue concerns the annotation of prosodic boundaries. Prosodic constituency and prosodic boundaries are difficult to transcribe in any language. There is also a theoretical debate in linguistics concerning consistent definitions and identifications of these boundaries (see discussion in Ladd 2009, 288-290). Quite frequently, there are situations in which the phonetic and phonological cues involved in segmentation of prosodic boundaries may be difficult to identify. Furthermore, when labeling prosodic boundaries it is difficult to de-couple the prosodic labeling process from inferences based on judgements from the morphosyntactic makeup of the utterance. Once again, however, the process of transcription itself gives rise to phonetic and phonological patterns that help mark these boundaries. The method I have used for overcoming some of the ambiguities is to re-code the prosodic boundaries for the same piece of data, on several different occasions. Comparison across the different coding sessions does reveal some consistency. Ideally, it would be best to have several people code and judge the prosodic boundaries of the data. This was not possible for the current study.

Chapter 3

Tonal Properties of Lakota Utterances

3.1 Introduction

In this chapter I propose an analysis of the tonal characteristics of Lakota declarative and interrogative utterances. Existing descriptions of Lakota grammar do not provide a complete description of the post-lexical phonology, intonation, or prosody of the language. Concerning the prosodic characteristics of Lakota, only lexical stress has previously received great attention. The studies on lexical phonology provide a good starting point for the analysis of Lakota intonation since, as I will show in this chapter, lexical stress interacts with the intonational properties of the language. In what follows I set the stage for the investigation of Lakota intonation by first considering the role of pitch at the lexical level. In section 3.2, I review the phonological properties of lexical stress and, based on a small phonetic study of isolated words, I show that pitch is only one of a group of acoustic correlates to lexical stress. Then, in sections 3.3 and 3.4, I analyze the intonation of larger constituents by examining the tonal properties of declarative utterances. The Lakota declarative corpus is drawn from (i) a subset of the natural narrative data and (ii) a subset of the scripted conversation utterances (both described in section 2.3.1). Section 3.5 is an analysis of Lakota interrogative utterances, based on data from the scripted conversations and elicitation data tasks (oulined in section 2.3.1). The results of of the interrogative analysis are compared to the declarative analysis. Finally, in section 3.6, I summarize the principal findings from this investigation and discuss several implications of the results. The discoveries made here are significant for the subsequent analysis of prosodic phrasing, presented in Chapter 4.

3.2 The Role of Pitch at the Lexical Level

3.2.1 Previous Descriptions of Lexical Stress and Tone in Lakota

There is a substantial body of previous work aimed at formulating simple phonological rules for word-level lexical stress in Lakota. This body of work begins with the Boas & Deloria (1941) grammar of Lakota and culminates with the formulation of the Dakota stress rule for placement lexical stress by Shaw (1980) and Shaw (1985). The general agreement between all these descriptions is that lexical stress is an important feature of Lakota. Here I briefly summarize this body of knowledge.

Boas & Deloria (1941) claim that stress placement in Lakota is rule governed. For the most part the stressed vowel is the second one in the word, and generally this is also the second syllable in the word. Some sample words that satisfy the second syllable stress pattern are shown in example (4) below.[1]

(4) Lakota words with second (or only) syllable stress.

	word	*gloss*
a.	matȟó	"bear"
b.	iyáye	"he started to go there"
c.	lowáŋpi	"they sing"
d.	šá	"red"

Chambers (1978) and Shaw (1980) formalize the second syllable stress assignment with a phonological rule. As exemplified even in the earlier periods of the work on Lakota grammar, however, there are many exceptions to the simple pattern of second syllable stress. Several disyllabic words with first syllable stress are displayed in example (5).

[1] The written examples in this section are from various sources in the literature and from my own data. For more examples refer to Boas & Deloria (1941), Shaw (1985), Rood & Taylor (1996), and Cho (2006).

(5) Lakota disyllabic words with first syllable stress.

	word	*gloss*
a.	šúŋka	"dog"
b.	wóte	"he eats (things)"
c.	thípi	"house" or "they live"
d.	líla	"very"
e.	t'áǧe	"bitter"

Building upon, and extending, the prior work by Carter (1974) and Chambers (1978), Shaw (1980) formulates the Dakota Stress Rule (DSR) which predicts second syllable stress and is ordered inside the lexical phonology in a way that explains many of these exceptional first-syllable stress cases. The ordering of rules is based on information incorporated from various parts of Lakota morphology and phonology. For instance, Shaw notes that one class of exceptions are the C-final (CVC) stems in Lakota. There is a rule of [a]-vowel insertion whereby these stems surface as CVCV. If the Dakota stress rule, which is a lexical level rule, applies before the insertion of this vowel it would explain many of the so called "exceptions" to second syllable stress. The apparent exceptional stress in *šúŋka* in example (5a) is one such case. There are further classes of exceptional stress that Shaw explains by the ordering of other lexical phonological rules. These include vowel deletion and vowel coalescence rules that apply after the assignment of primary stress. For example, derivation of the root word followed by glide deletion, and then followed by vowel coalescence explains why *wóte* in 5b surfaces with first syllable stress. The surface form of this word is derived from a construction that consists of two morphemes: *wa-yúte*. The glide /y/ in intervocalic position is deleted and the [aú] vocalic sequence collapses to [ó], giving rise to the surface form *wóte*. Shaw also notes that there are outer layer morphological processes, such as the addition of the plural marking suffix/enclitic *-pi* in 5c, which make the lexical stress seem "exceptional". Despite all the proposed rules, however, there are synchronically genuine exceptions to the assignment of stress by DSR. For this reason the orthographic transcription of Lakota generally marks the location of stress.

The outline of Lakota grammar by Rood & Taylor (1996), aside from summarizing the nature of lexical stress placement, briefly mentions the possibility of existence of pitch accent in the language and how this relates to lexical accent and acoustic stress (although the authors do not use this terminology). Rood and Taylor discuss how morphological and fast-speech processes that cause vowel coalescence give rise to falling or rising pitch patterns on the lexically stressed syllable. They also briefly describe the placement of secondary stress on longer words. Like the previous studies by Shaw and others, most of this discussion takes place in the context of the underlying, lexical, level of representation.To my knowledge, in none of the above-mentioned studies on Lakota is there a detailed phonetic analysis to back the findings regarding pitch.

Chambers (1978) and Shaw (1985) further discuss the processes of reduplication and compounding and how they interact with lexical stress assignment. Of these compounding is the more relevant for the current study on intonation because such constructions may contribute one or two pitch accent peaks when inserted in a sentence. Lakota uses compounding very frequently. The types of compounding are mainly distinguished by the kind of stress that they receive. There are three kinds of lexical-level compounding in Lakota (de Reuse 2006). In the first type of compounding, called "lexical compounds", there is a single main stress on a pair of words that are attached together. The stress generally falls on the second syllable, as predicted by the DSR. The second, slightly more outer layer, type of compounds are generally referred to as "syntactic compounds". In these compounds both members keep their original (presumably DSR-assigned) stress, but the stress on the second word of the compound is reduced to secondary status. The third type of compounding is called noun or verb stripping by de Reuse (2006). In this type of serial compounding both members keep their full DSR-assigned stress. In the table in (6) I have listed one example of each type of Lakota compound construction. The intonation in some of these compounds is analyzed later in this chapter, in section 3.3.3.

(6) Three types of Compounding In Lakota

	compound word	*gloss*	*type (source)*
a.	haŋ-wákȟaŋ	"northern lights" (night+holy)	lexical (Shaw 1985)
b.	háŋ=wakȟáŋ	"holy night" (night+holy)	syntactic (Shaw 1985)
c.	úŋštima máni	"He walks while sleeping."	stripping (de Reuse 2006)

Shaw (1985) discusses two additional stress rules which are specific to the Stoney Dakota dialect: the Stoney stress rule and the Imperative stress rule. With the exception of the imperative stress rule, the stress assignment rules are lexical level phenomena, cast within the traditional model of lexical phonology. The imperative stress rule of Stoney is said to be a post-lexical rule because (i) it contains the enclitics in its domain, (ii) it leaves intact the stress assigned by the Dakota stress rule, (iii) it is not constrained by the strict cycle condition or the elsewhere condition of lexical phonology, (iv) its function is sentence-level illocutionary force, and (v) it is always phrase-final (Shaw 1985:195).

3.2.2 The Acoustic Correlates of Lexical Stress: Results from a Small Study

The acoustic properties of lexical stress have been analyzed for other languages before (see, for example, Beckman (1986) for analysis of English and Japanese). It is generally agreed that pitch, duration, amplitude, and spectral tilt play primary roles in cueing lexical stress. However, how much of each feature is used depends on the language. Japanese is generally described as a melodic accent language because it uses pitch as a primary cue for prominence. English generally uses all of the above mentioned acoustic parameters; it is described as a dynamic stress language.

Previous studies of Lakota have, primarily based on impression, stated that the language uses pitch to mark lexical stress. One study that deals directly with the phonetic aspects of lexical stress in Lakota

is Cho (2006), already cited in the literature review in Chapter 1, section 1.5.2. Cho examines several acoustic parameters in relation to lexical stress. He concludes that Lakota primarily uses pitch for marking lexical stress, but that other acoustic factors are at work. In particular, Cho shows that in isolated disyllabic words where the lexical stress is on the second syllable, it is not the F0 peak value that cues stress. Rather, it is the drastic fall of pitch on the second syllable that partly signals its prominence. Cho finds no significant correlation of lexical stress with vowel duration. He does find a positive correlation between stress placement and change in intensity in certain word-onset segmental contexts. He also shows that aspirated stop consonants in initial position show a significantly longer voice onset time (VOT) when the initial syllable carries lexical stress.

In what follows I use a set of isolated Lakota words to test the correlation between acoustic properties and stress. I first describe the corpus of words used and then I present the results.

3.2.2.1 Corpus of Lakota Words Used

The acoustic analysis of lexical stress presented here is based on a small corpus of isolated words gathered from speaker DBW. The target list, which was organized with assistance from the speaker, contains polysyllabic words (two syllables or longer) that start with a CV syllable where the C is a velar stop and V is a vowel. Three dimensions of variation are explored. The first dimension is the manner of the stop release; all four manners (/k/, /kh/, /kȟ/, /k'/) were attempted. The second dimension samples the vowel space; all eight vowels (/i/, /e/, /a/, /o/, /u/, /iŋ/, /aŋ/, /uŋ/) for the V in the initial CV were attempted. The third dimension involves lexical stress; both first syllable and second syllable stress were sampled. The desired list was obtained, but with some gaps. Certain combinations of the segments and stress pattern were either rejected by the speaker or the desired sequence was not discovered in dictionaries and grammars. The prepared word list was randomized and the speaker repeated each word three times, on two separate occasions. Distractor words were inserted mainly to keep the speaker from falling into a repetition routine. The distractors include words or phrases without the velar stop onset and without the

same length restrictions. They are used for qualitative and phonological observations on pitch accents. The recordings were made in a sound-attenuated booth, in the phonetics lab at the University of Colorado. They were digitized in real time at a rate of 44.1 kHz (24-bit). No subsequent data transfer was needed.

The data was coded for word, syllable, and segment boundaries. VOT boundaries for all the velar stops were coded as well. The data was organized into groups according to the manner of the velar stop release, location of the following vowel, and the stress type (first or second syllable). The extraction and analysis of pitch, vowel duration, syllable duration, and VOT values were carried out in *Praat*.

3.2.2.2 Analysis and Discussion

A. The F0 Peak Analysis

The results from the isolated word analysis indicate that local F0 maxima are generally associated with lexically stressed syllables. This is true for monosyllabic, disyllabic, and polysyllabic words uttered in isolation. It is easiest to illustrate the basic pattern with one of the poly-syllabic, distractor, words from the corpus. Figure 3.1 shows a three-syllable word carrying second syllable lexical stress.

If a disyllabic words carries initial stress, then the F0 contour of the word starts high at the onset of the first vowel and drops sharply to a low level during the second syllable. A token of first syllable stress, for the word *kȟáte*, "hot", is shown in figure 3.2. This example also illustrates the effect of one of the onset consonants on the F0 contour; the onset [kȟ] causes the F0 to start high at the onset of the stressed vowel and drop (slightly) to a plateau for the major portion of the vowel.

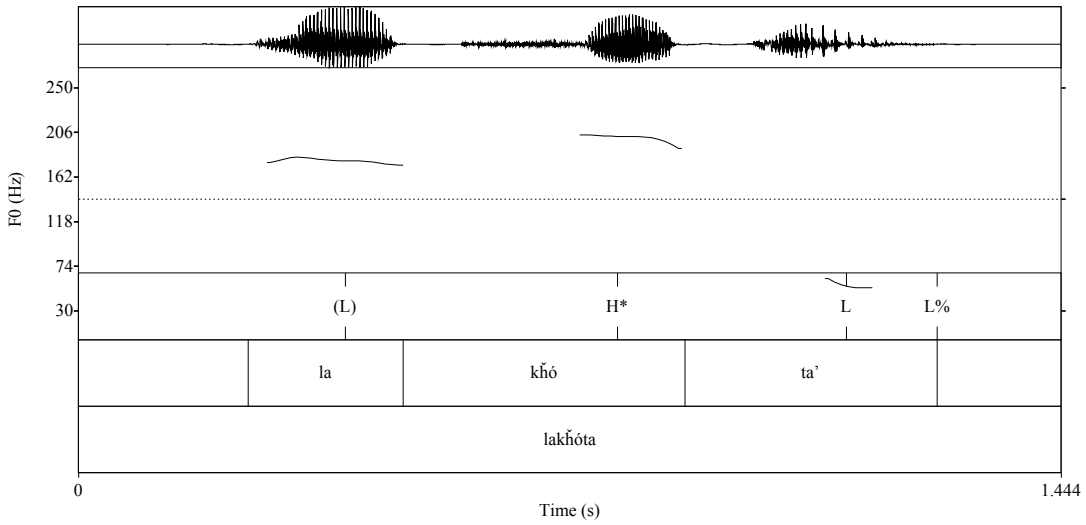


Figure 3.1: Local F0 peak on the second syllable of the word *lakȟóta*, one of the distractor words in the isolated word database.

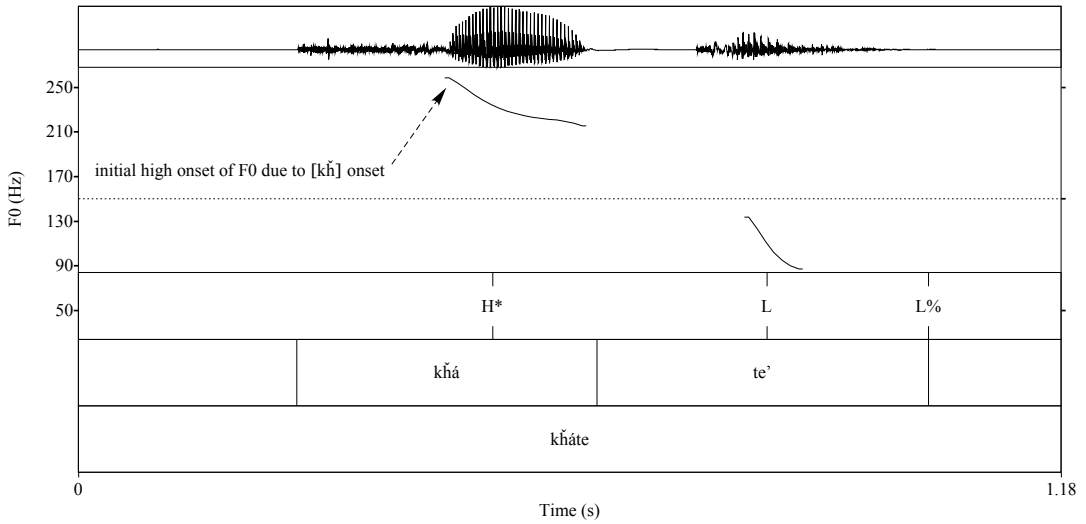


Figure 3.2: Local high F0 plateau aligned with the lexically stressed initial syllable of *kȟáte*.

The situation in disyllabic words with second syllable stress is somewhat more complex. While a local F0 peak or plateau occurs in the temporal bounds of the lexically stressed syllable, the initial (stress-less) syllable is not always mid or low. In the example given in figure 3.3, an F0 plateau starts on the first syllable of the word *khuté*, "he shot it". The plateau is interrupted by the voiceless [t] onset on the second syllable. The F0 high resumes on the second syllable (stressed) vowel. The start of the fall to the low end tone is at some point in the early to mid parts of the second syllable vowel.

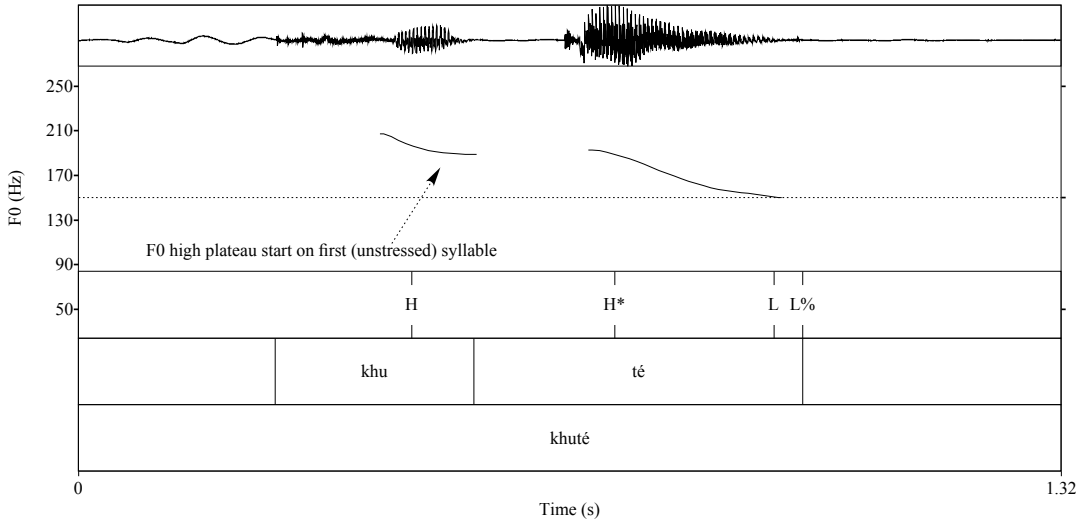


Figure 3.3: High level F0 plateau extending over both syllables of the disyllabic word *khuté*.

The comparison between figures 3.2 and 3.3 yields two interesting observations concerning the relation of F0 track events to lexical stress. First, the final low is phonetically much lower in the first syllable stressed word *kh̆áte* than in the second syllable stressed word *khuté*. The second, partly related, observation is that the first syllable stress word *kh̆áte* involves a wider pitch range, employing a sharp drop on the second syllable; the word *khuté* shows a more even pitch on both syllables. These observations hold across all the lexical stress dataset, for all vowels and all three types of voiceless stop release.

Based on these observations, it appears that one good correlate of lexical stress in such disyllabic words is the difference in peak F0 value between the second and first syllables. Figure 3.4 shows the average values of peak F0 difference, ΔF0, between the two syllables in disyllabic words with plain, glottal aspirated,

and velar aspirated stops in word initial position. The display shows bars for both first syllable stress and second syllable stress. Notice that larger average ΔF0 values obtain in cases with first syllable stress.

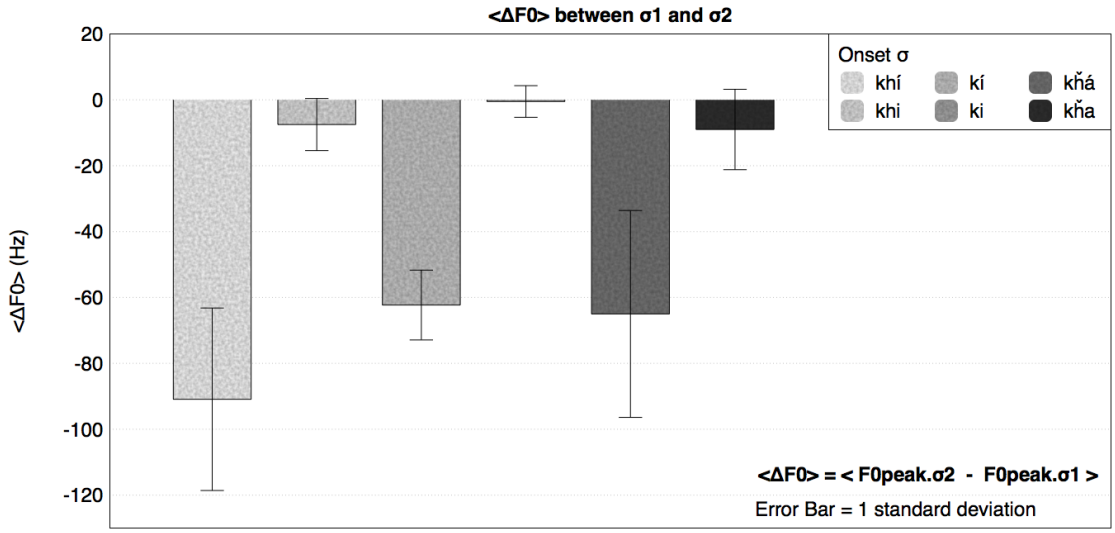


Figure 3.4: Correlation of the *difference* in F0 peak values between second and first syllable with the location of lexical stress. The data represents disyllabic words. The averages and standard deviation error bars are based on measurements from five repetitions of three different disyllabic words for each manner of stop release and stress type.

One possible phonological analysis of the ΔF0 result is as follows. The words uttered in isolation form individual intonational phrases with final low boundary tones. When the word has second syllable stress, the high tone that is associated with this stressed syllable is in phrase final position. This gives rise to a high tone placed right next to a low boundary tone. The high tone is slightly suppressed by interaction with the low boundary tone and the low boundary tone, in turn, is slightly raised by interaction with the preceding high tone. The phonetic result is a mid-level pitch on the second syllable.

The other, more problematic, observation is that 2nd-syllable stressed words with word initial [k], [kh], and [kȟ] consonantal onsets show an initial high on the first (unstressed) syllable. While it is generally acknowledged that these stop consonants phonetically raise the following vowel F0 onset (Hombert 1978), the effect is usually limited to a small timescale right after the stop release. It is clear from figure 3.3 that the F0 rise on the first syllable caused by the onset consonant drops only slightly to a high level that persists

throughout the entire first (unstressed) vowel. At this point, I do not have a good explanation to offer for this phonetic high effect. These word-initial phonetic highs are not limited to words uttered in isolation. The effect is also frequently observed when words with these consonantal onsets are placed in longer intonational phrases. I revisit this issue briefly when I discuss declarative pitch accent types, in section 3.3.3.8.

B. Durational Cues: Vowel Length and Voice Onset Time

Another factor that can contribute to the perception of lexical stress is duration. Duration can be measured for syllables and vowels. It can also be measured for certain features of individual consonants. For the small isolated word database here I have made two measurements of duration in +stress and -stress contexts. The results are inconclusive, but they do indicate that - at least in some contexts - vowel length and voice onset time (VOT) of initial consonants partly correlate with lexical stress.

Figure 3.5 shows the average duration of the first syllable vowel for five disyllabic words with first and second syllable stress contexts. Each word was repeated five times, over two different occasions. The first syllables examined are [khi] and [ki]. The results show that while vowel duration may not be correlated well with stress when the syllable onset is aspirated [kh], it does seem be effected by stress when the syllable onset is plain [k].

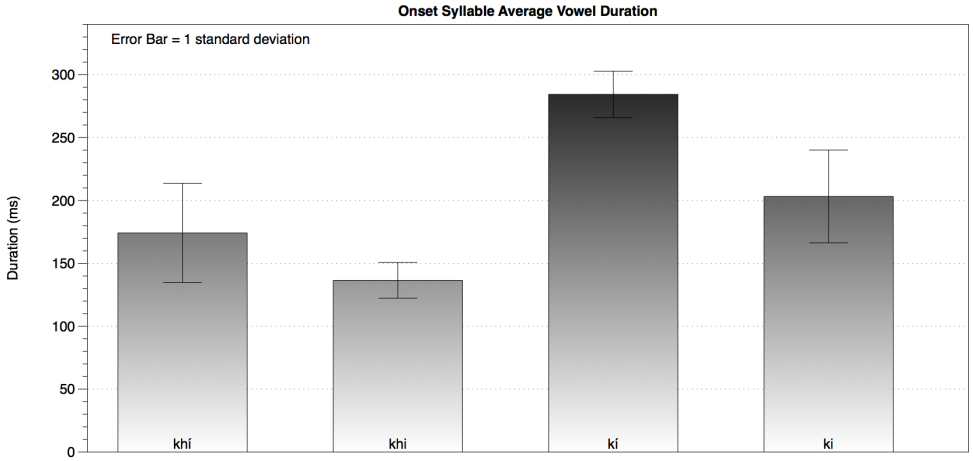


Figure 3.5: Relation between average duration of the first syllable vowel with lexical stress. The data represents disyllabic words. The averages and standard deviation error bars are based on measurements from five repetitions of five different disyllabic words for each manner of stop release and stress type.

Figure 3.6 shows the average VOT for the aspirated and plain velar stops for the same data subset as in figure 3.5. The word initial syllables are [khi] and [ki], sampled in both +stress and -stress contexts. The results of the VOT analysis for this subset of the data remains inconclusive.

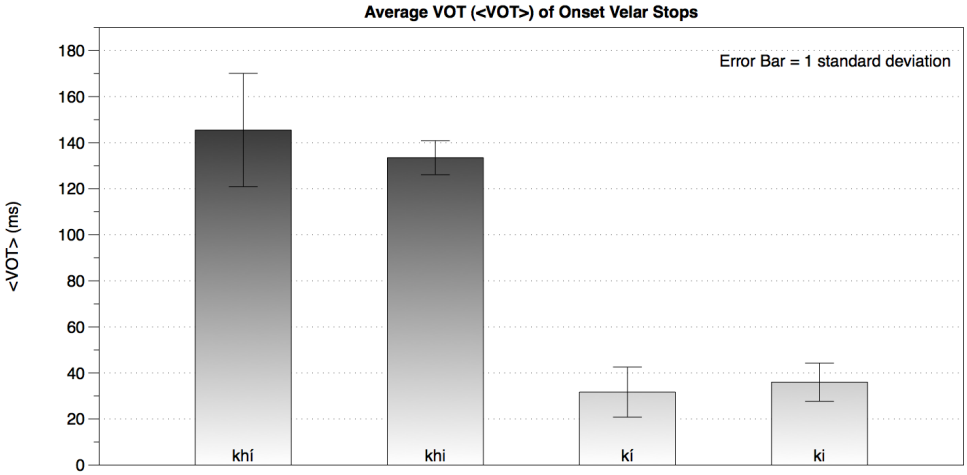


Figure 3.6: Results of average VOT of velar stops in onset syllables [ki] and [khi], in stressed and unstressed contexts. The data represents disyllabic words. The averages and standard deviation error bars are based on measurements from five repetitions of five different disyllabic words for each manner of stop release and stress type.

Both average vowel duration and VOT show some degree of correlation with lexical stress when the initial syllable onset consonant is the ejective velar stop, [k']. Figure 3.7 shows the average values for vowel duration and velar stop VOT in the syllable [k'u], in both +stress and -stress contexts.

The results here show that there may be factors besides tone involved in cueing lexical stress in Lakota. The general patterns are in agreement with Cho (2006), but there are some significant differences. Cho found a much better correlation of stress and VOT, in the context of the labial stop onsets. However, unlike the duration trends seen here in figures 3.5 and 3.7, Cho found no significant effect of stress on vowel duration (Cho 2006:14).

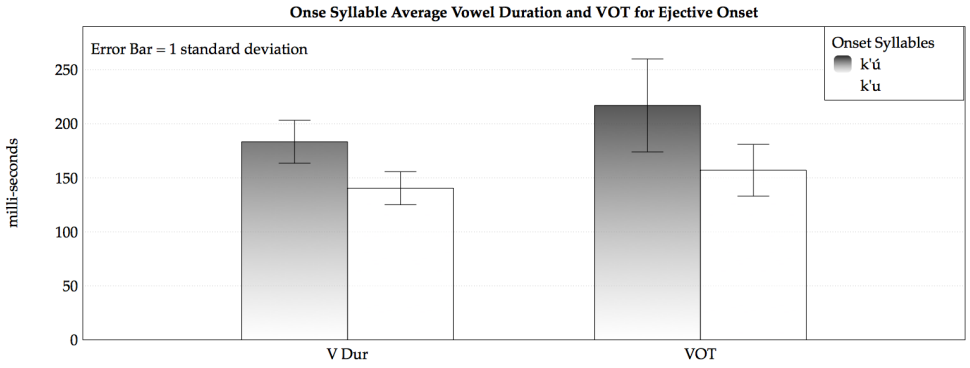


Figure 3.7: Correlations of vowel duration and VOT with lexical stress, for onset syllable [k'u]. The averages are based on five words, repeated five times over two different occasions.

3.2.2.3 Summary

The results of this small analysis of the phonetic cues for syllable strength generally support the claim that Lakota is a lexical stress language. Pitch, or at least pitch differences, appear to be a good correlate of lexical stress. However, there are contexts where pitch is not a very good measure, and yet lexical stress is still perceived. I will comment on this observation again in the discussion of "de-accenting" in declarative utterances (section 3.3.3.9).

In certain segmental contexts, durational cues may be significant. However, the results of the current analysis remain ambiguous due to several complications. One of difficulties in the measurements of duration (both for vowel length and for VOT) is the rate of speech. It is both obvious and measurable in the data that the speaker did not use a uniform speech rate. In order to compensate for this one has to either formulate a normalization technique for speech rate or create a much larger sample and design the experiment with controlled speech rates. These investigations are left for another study. Here I simply conclude that lexical stress in Lakota exists and is measurable with several acoustic parameters. This stress is generally accompanied by tonal peaks, but disassociations can occur. Furthermore, there can be high tones in syllables where there is no lexical stress at all.

3.3 Intonation in Lakota Declarative Utterances

3.3.1 Declarative Utterances in Lakota - a review

Descriptions of declarative statements as a type of utterance in Lakota exist in most of the grammars of the language (Boas & Deloria 1941; Rood & Taylor 1996; Ullrich 2008). However, it is not always clear what is meant by a declarative in these grammars. There is a wide range of declarative-like sentences cited that vary in degree of emphasis, speaker perspective, and directness of speech. All the grammars agree, however, that Lakota has a set of sentence final enclitics that can be used for marking a sentence as an assertion. Rood & Taylor (1996:475) indirectly state that there is a simple declarative sentence type which is unmarked. They contrast these with assertions which are always marked with some sentence final enclitic. Ullrich (2008) also makes several indirect references to simple sentence types.

The most complete discussion of declaratives as a sentence type is found in Boas & Deloria (1941). In their grammar Boas and Deloria discuss declarative and several assertive particles that occur at the ends of sentences. The first thing they state concerning declaratives is that the "end of a declarative statement of a commonly known fact, or the mere statement of a fact previously not known to the hearer and without expression of an opinion regarding it is expressed by the terminal glottal stop, both by men and women" (Boas & Deloria 1941:109). An example of the declarative final glottal stop given by Boas & Deloria is shown in the phrase in (7).[2] The morphemic gloss line is my own addition.

(7) *waná 'íŋyaŋkapi'*

waná 'íŋyaŋka-pi='

now run-pl=decl

"Now they ran." (Boas & Deloria 1941:109)

[2] For transparency, I have converted Boas and Deloria's transcription system to the orthography used in my study. In the process, however, I have kept intact all the sound distinctions that Boas and Deloria marked in their grammar.

Boas & Deloria go on to discuss other types of sentences that they call declaratives. Some of these sentence types are referred to as assertions in the later grammars. One example is the enclitic particle *ye*. According to Boas & Deloria, this enclitic occurs at the end of exclamatory sentences, used to call the attention of the hearer to the present states or actions. It is also used in "energetic" statements which are followed by an imperative. In example (8), the first sentence is the statement and the second is the imperative.

(8) *'osní ye* *thimá glá yó*

'osní=ye thimá glá=yó

cold=decl inside go=imp

"it's cold! go in!" (Boas & Deloria 1941:109)

The *ye* enclitic is also used in direct quotations of a statement that would have ended in a glottal stop declarative if it was not quoted. One of the examples given by Boas & Deloria is shown below in (9). Notice that the quotation is followed by the verb *'eyé'*, "he said". This verb, uttered at the time of speech by the actual (present) speaker, receives the expected glottal stop declarative.

(9) *tókȟa* *'ibláblešni yé* *'eyé'*

tókȟa 'ibláble=šni=yé 'eyé='

matter 1sg.go=neg=decl he.said=decl

"I cannot go further, he said." (Boas & Deloria 1941:109)

Boas & Deloria also describe the use of another enclitic, *yeló*, with declarative-like functions. They state that "this enclitic is used for any declarative statement intended to interest the hearer or as a remark not addressed to an particular person. It always implies a personal opinion of the speaker." (Boas & Deloria

1941:110). One of the *yeló*-marked declaratives they cite is displayed in example (10).

(10) *waȟtémalašni yeló*

waȟté-ma-la=šni=yeló

1sg.pat$_{infix}$-like=neg=decl

"She does not like me." (Boas & Deloria 1941:110)

Finally, Boas and Deloria state that the declarative glottal stop, as in example (7), is not used when shouting or calling. It is also not used with direct imperatives, interrogatives, optatives, and some kinds of negative sentences. The glottal stop is, however, placed at the end of the enclitic *tkȟá* (shortened to *kȟá*) which is used to mark a statement as contrary to fact.[3]

Rood & Taylor (1996) discuss several outer enclitics that have various types of emphatic and assertive meaning, but they do not mention the simple declarative glottal stop. Ullrich (2008) does not explicitly mention the simple declarative glottal stop as a sentence type marker either. However, while discussing the fast speech contraction of the plural marker suffix *-pi* to [-p] or [-b] (Ullrich 2008:772), he mentions that one of the ways of determining if this contraction has taken place is to listen for the sentence final glottal stop that occurs when a statement ends in a vowel. Two of the minimal-pair examples cited are shown in (11).

(11)

	Slow Speech	*Fast Speech*	*gloss*
a.	yuhápi	yuháp	"They have it."
	yuhá	yuhá'	"He has it."
b.	wačhípi	wačhíp	"They are dancing."
	wačhí	wačhí'	"She is dancing."

[3] A full discussion of all these sentence types is beyond the scope of this thesis. Furthermore, the database for my investigation here does not contain all these types of sentences.

The descriptions in these later grammars indicate that there is some ambiguity concerning the use of the final glottal stop for simple declaratives. It is possible that the final glottal stop enclitic was used by older speakers in the early to mid parts of the 20th century and that its usage has diminished among modern speakers. It is also possible that certain speakers use it more frequently than others. Despite this uncertainly, the review above indicates that there are grammatical means in Lakota for coding different kinds of declaratives. As I will show below, declarative utterances in Lakota have interesting tonal properties in addition to this rich morpho-syntactic coding. The analysis of the edge tones of intonational phrases also sheds light on the issue of the simple declarative glottal stop.

3.3.2 The Declarative Data Subset

From the entire database described in 2.3.1, I compiled a small subset of utterances for the analysis of Lakota declaratives presented here. Sentences from the spontaneous narratives (from all three speakers), the semi-spontaneous scripted conversations, and the elicitations are included in this small subset. Although each of the speakers produced many sentences in the respective tasks, I used a set of criteria for choosing utterances to be included for analysis. First, only phrases that I considered unambiguous intonational phrases with measurable properties are used for the description of intonation. I only comment on some of the ambiguous cases in the final discussion. Second, I carefully sampled the database so that utterances with different numbers of stressed syllables and different kinds of edge tones are all represented. Third, I tried to incorporate sentences that contain words with both first syllable and second syllable stress, interspersed with different numbers of unstressed syllables. The sample of the sentences also contains a few lexical and syntactic compound words. The majority of the intonational phrases included are verb-final. There are just a few exceptional word orders, which I address very briefly in the final discussion.

After the data are filtered based on the selection criteria mentioned above, the final declarative subset for the current analysis includes a total of 124 intonational phrases. This subset of Lakota declarative utterances, along with English translations, can be found in the tables in Appendix A; the declarative

phrases are labeled with the abbreviation "decl." in the utterance-type column of the tables. The phrases in the declarative corpus subset are distributed among the different genres and tasks as follows. A total of 85 intonational phrases are included from the narratives and autobiographical monologues from all three speakers (DBW, PRS, and SOF). There are 25 intonational phrases from the scripted, semi-spontaneous conversations with speaker DBW. A small sample of 14 elicited phrases from speaker DBW is also included. The intonational phrases in the subset vary in length. Some are only one word phrases while others contain up to seven or eight words.

The analysis I provide in this section is based on observations and measurements of major tonal peaks inside phrases and tonal movements/stabilities at the edges of phrases. Pitch peaks are labeled for all major category Lakota words (nouns, verbs and adverbs) and some function words that carry lexical stress (certain particles, conjunctions, and enclitics). When a single word is an utterance it always carries at least one major peak. But, as I will show, in multi-word utterances not all major category words carry a pitch accent. Many of these de-accented, or nearly de-accented, words are the sentence final verbs. In phrase-medial position, the de-accented items tend to be adverbs or conjunctions. The near de-accenting often takes the shape of a sudden compression in pitch range.

The Lakota utterances represented in this declarative corpus vary in focus structure. There are predicate focus, narrow focus, and contrastive focus sentences in all the narratives, conversations, and elicitations. Lakota narratives frequently contain quotative sentences, which are marked by sentence final enclitics. The most frequent quotative marker used in the narratives in the database is the encliticized verb *kéye*. I discuss this enclitic briefly in section 3.3.5, and then again in section 4.5 in the context of phrasing of several other enclitics.

3.3.3 Core Tones and their Alignments with Lexical Stress

3.3.3.1 The H* Nucleus of Pitch Accents

Observation of the declarative data, from all three speakers and all genres, reveals a pattern of pitch movement that is rather frequent in Lakota. The F0 contour typically starts in the middle or low part of the pitch range and remains so until the speaker approaches a lexically stressed syllable on one of the major category words. The fundamental frequency usually begins to rise right before the onset of the stressed syllable. By the time the speaker reaches the mid to late portions of the vowel in the lexically stressed syllable the frequency has reached a peak. After this point - during syllable offset and into the next, unstressed, syllable - the frequency falls to a low target. The F0 peak that occurs during the stressed vowel corresponds to the nucleus of the pitch accent in Lakota. Since this nucleus is an intonational peak I label it as H*. In most cases the peak is aligned within the temporal bounds of the stressed syllable. The "ideal" pattern of pitch movement is schematically illustrated in figure 3.8.

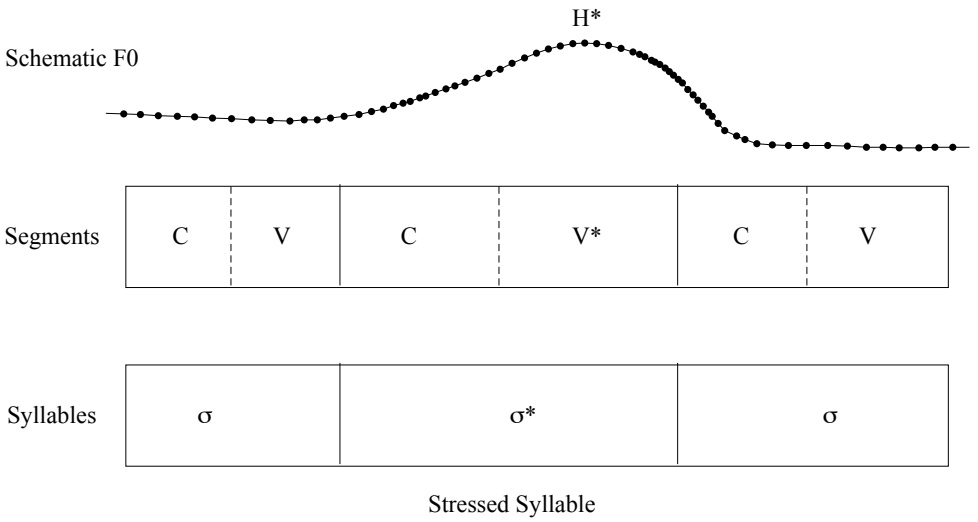


Figure 3.8: Schematic drawing showing an ideal pitch accent movement in Lakota. The H* is the nucleus of the pitch accent, corresponding to the F0 peak.

This basic pitch movement and peak alignment can be shown with single word intonational phrases. Example (12) and accompanying pitch track in figure 3.9, show a one word phrase carrying an H* accent that is associated and aligned with the lexically stressed second syllable on the word. Note the initial mid-level tone, followed by a rise to a peak, which is then followed by a post-tonic drop to an L tone.

(12) wa-yáwa-pi

indef$_{obj}$-read-pl

"They're reading." (verb) *or* "a reading" (noun) [Speaker DBW09:E]

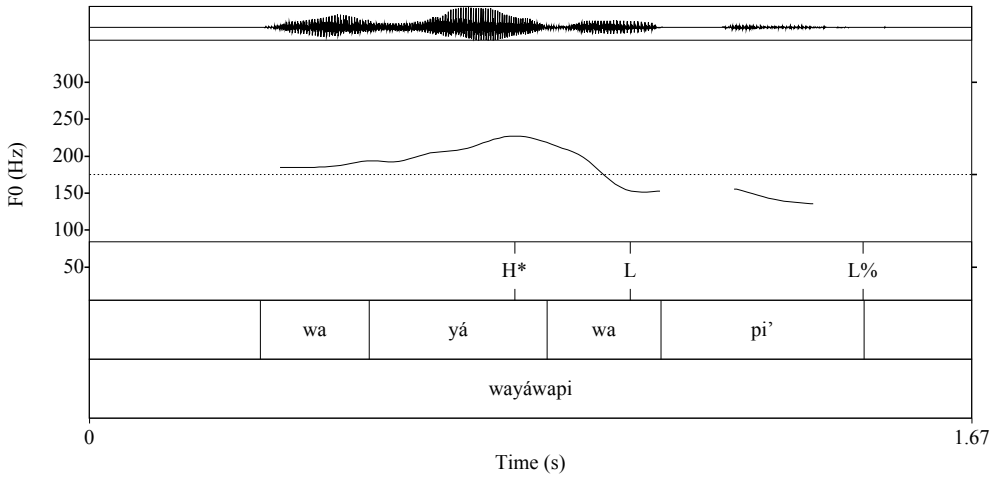


Figure 3.9: Lakota one word declarative utterance in example (12), with H* peak on stressed second syllable.

The H* nucleus is the minimal unit needed to form a pitch accent in Lakota. In some contexts in declarative utterances - depending on the segmental makeup of the words and other factors such as speech rate - the H* peak may be the only tangible element of the pitch accent visible in the F0 contour. In such cases the pitch accent that I posit in the analysis is a simple H*. Example (13) is a declarative sentence in which the first word in the utterance is a monosyllabic noun. This noun carries only a pitch peak on its stressed syllable, as shown in the pitch track in figure 3.10.

(13) pȟé ektá á:ta óta

head on$_{PP}$ entirely$_{ADV}$ be.many$_{V-S}$

"There were lots [of things] on their heads." [Speaker DBW06:N]

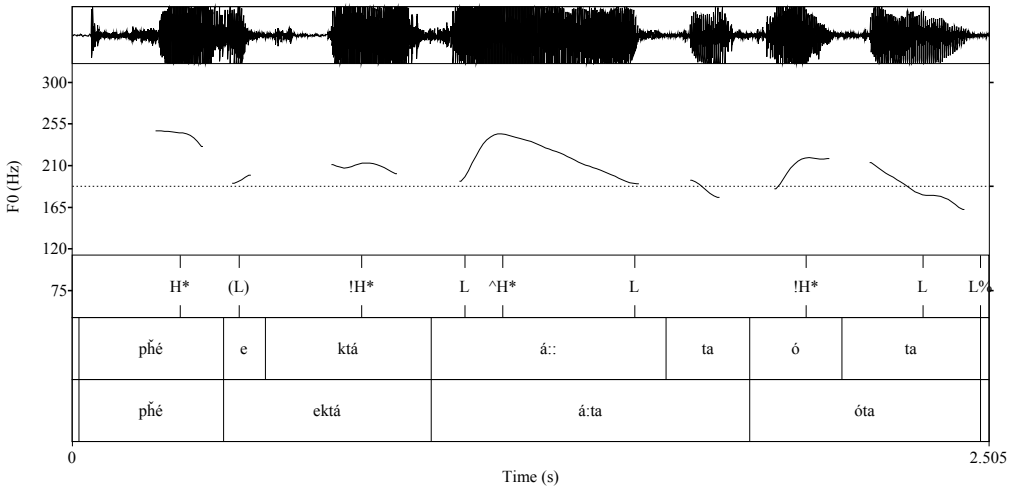


Figure 3.10: Pitch contour for the multi-Word declarative utterance in example (13). This phrase starts with a monosyllabic word that carries an initial simple H* pitch accent. This is followed by three, more complex, pitch accents on the subsequent words.

There are several complexities in the F0 track of example (13) that I will discuss throughout this section. The clause initial noun is followed by three words: a postposition, an intensifier adverb, and a clause-final stative verb. These words all contain their own H* nuclei. There are movements before and after the H*s that approximately resemble the schematic drawing shown in figure 3.8. Note that all three words start with vowels. It is very frequent for V-initial words in Lakota to be pronounced with a phonetic glottal stop onset. These inter-word glottal stops are very audible in example (13); they punctuate the pitch track in figure 3.10 with several sharp discontinuities. The inserted glottal stops cause the F0 to rapidly drop at the end of the previous word and rise back from a punctured hole into the vowel onset of the next word.

3.3.3.2 The Complete Pitch Accent: LH*L

As previously stated, the majority of Lakota words have lexical stress on the first or second syllable. One consequence of this prosodic organization is that the intonational pitch peaks appear early in the word. Based on the model discussed in figure 3.8, the F0 contour of a single major category word inside an intonational phrase can maximally exhibit the following pattern: start in the mid or low range at the beginning of the word, rise quickly to the H* peak on the stressed syllable of the word, and then drop to a low level plateau within the time period of the next, or the following, post-tonic syllable. Assuming that this series of movements form the core tone on the word, then the most obvious way of representing the full pattern in terms of L and H tones is an LH*L pitch accent. The initial L is the leading tone, the H* is the nucleus, and the final L is the trailing tone.

Some declarative tokens contain words with localized pitch movements in which all three of the tones in the maximal LH*L pitch accent are realized in the F0 contour. The emphatic adverb *áta* in example (13), figure 3.10, shows a near-complete LH*L pattern. However, in a majority of the cases in the data, it is difficult to identify both the leading and the trailing parts of the pitch accent unambiguously. The leading L is frequently absent or its realization as a target tone is unclear. The trailing L can be undershot, or it can show variation in its temporal alignment and extent, depending on context. The full LH*L pitch accent is generally realized in complete form only when the major category word that carries it is in phrase medial position, in an uncompressed pitch range. In these contexts - if the speech rate is not too fast - there is sometimes enough phonetic material around the pitch accent to make the judgement of a leading L target less ambiguous. Example (14) shows a case of an intonational phrase-medial emphatic pitch accent in which both the leading and the trailing L tones are realized.[4] Note the significant rise-peak-fall pitch movement on the stressed syllable of the adverb *líla* in figure 3.11.

[4] In my analysis here I attribute the extreme pitch excursions and lengthening of *líla*, in example (14), and *á:ta*, in example (13), to degree of emphasis.

(14) maštíŋča-phuté líla óta

buffalo berry very$_{ADV}$ many$_{V-S}$

"There were very many buffalo berries." [Speaker DBW06:N]

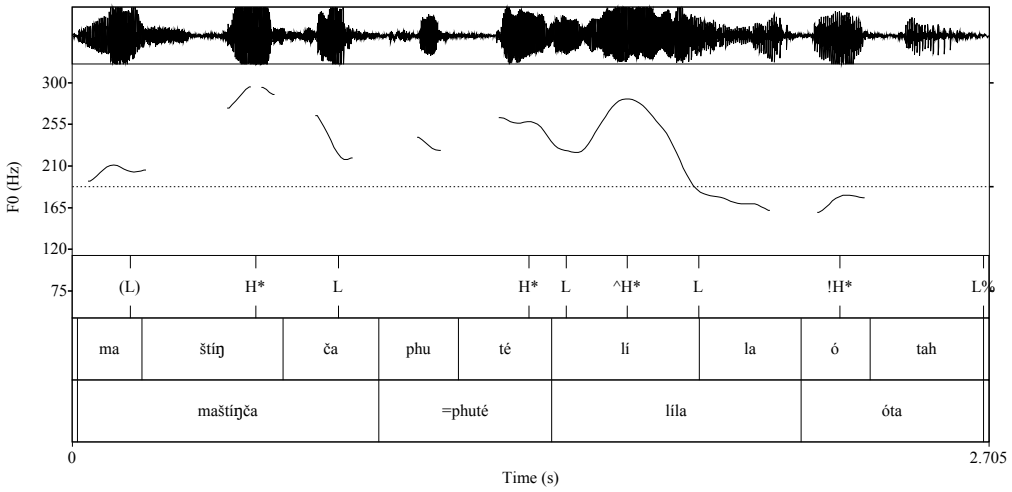


Figure 3.11: Complete realization of the LH*L pitch accent on the phrase medial adverb *líla*; figure corresponds to example (14).

When either the leading L tone or the trailing L tone is missing - or when they are difficult to identify - I take a more conservative, phonetic, approach and designate the pitch accent as H*L or LH*, respectively.

3.3.3.3 The H*L Pitch Accent

In some situations in Lakota phrases, pitch accents phonetically appear as a fall from a pitch peak to a low tone in post-tonic position. The tonal peak itself is associated, and frequently aligned, with the stressed syllable of a major category word. The drop from the H* peak to the low level takes place within a short space of time after the peak, giving rise to an early post-tonic "elbow" in the F0 contour of the word. Such peak-plus-falling tonal movements in the vicinity of a stressed syllable can most transparently be described as H*L pitch accent events. The post-tonic L tone can continue as a level plateau to the next word or to

the end of the intonational phrase, depending on the phonetic material that follows the accented word and how the utterances is phrased. Example (15) consists of an initial stress polysyllabic word that constitutes an intonational phrase by itself. Figure 3.12 displays the F0 contour of this simple phrase.

(15) túŋweni

never$_{ADV}$

"never" [Speaker DBW09:WE]

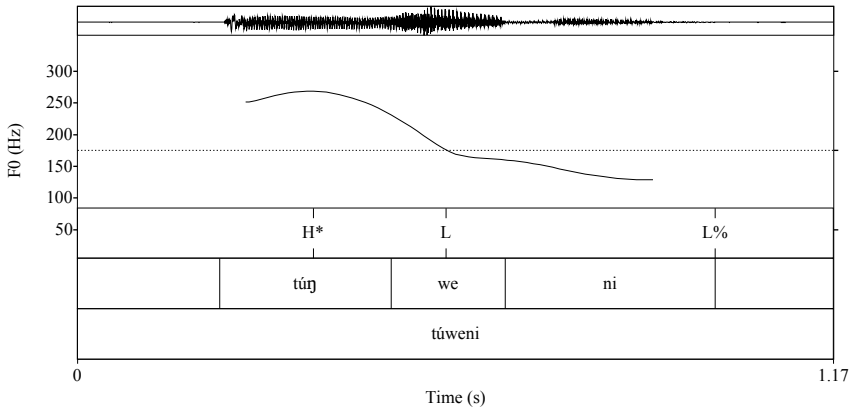


Figure 3.12: Lakota one word declarative utterance in example (15), with H* peak on stressed first syllable.

As indicated by the F0 track and the tonal transcription in figure 3.12, the H* peak is aligned with the stressed syllable. The post-tonic drop to a low elbow occurs relatively quickly and is followed by a somewhat shallow, continuous drop to the low boundary of the intonational phrase. In the tonal transcription for example (15) I assume that the post-tonic L target occurs at the elbow of the contour. The tonal event around the stressed syllable of the word is thus described as an H*L pitch accent.[5] The length and slope of the low level stretch that follows the H*L accent depends what comes next in the utterance. In example (15), and in the one-word intonational phrase shown earlier in example (12), it is the boundary tone that comes next.

[5] These pitch accents are rather similar to the types of tonal events discussed in the ToDI transcription of Dutch intonation (Gussenhoven *et al.* 2003).

In multi-word intonational phrases, the H*L pitch accent can appear on several major category words. In these contexts each H* nuclear peak is followed by a near-immediate drop to a post-tonic L target. Subsequent peaks can show a declining staircase (i.e., downstep) pattern. Example (16), figure 3.13, illustrates a sentence with five consecutive accent-bearing words, four of which carry H*L pitch accent patterns.[6]

(16) čhaŋté waště-ya iyúha naŋpé či-yúza-pi

heart good-advz everyone$_{QUANT}$ hand 1.agt.2.pat-take hold of-pl

"With good heart I shake hands with everyone of you." [Speaker DBW06:N]

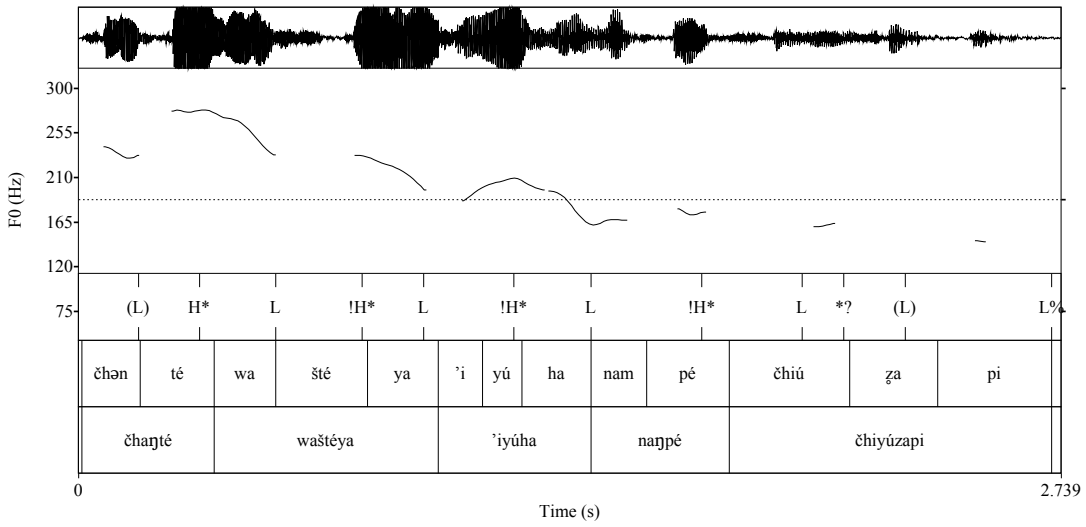


Figure 3.13: Lakota multi-word utterance in example (16), with H*L peaks on subsequent stressed syllable.

As an aside, it seems relevant to point out an interensting utterance-final pitch range phenomenon in the F0 contour in figure 3.13. Note that towards the end of the utterance the pitch range of the speaker has compressed dramatically. The compression is to such an extent that the tonal analysis of the last potential pitch accent in the phrase is unclear. I have labeled the stressed syllable of the last word [*čhiyúzapi*] with

[6] Lakota utterances with five or six independent words are generally grouped into two or more intermediate phrases (refer to Chapter 4, section 4.4.2). The utterance in example (16) is a formulaic construction, frequently used in the introduction of almost any speech or story. The observation of a regular, cascading H*L pitch staircase in a single phrase in figure 3.13 may be related to the fact that the construction in example (16) also has an idiomatic prosodic property.

"*?" in the tonal tier, indicating that the accentual nature of this syllable remains ambiguous. Lakota utterances can exhibit pitch span compressions at several places throughout the duration of the intonational phrase. This is evidenced in many parts of the Lakota data analyzed in this study. I discuss these pitch range phenomena at some more length in the context of de-accenting, in section 3.3.3.9, and again in the context of large scale pitch variations in section 3.4.1.

Finally, it is important at this point to address a fundamental complication with the analysis of the falling pitch accents presented in this section. Up to this point I have stated that the falling pitch accents can be analyzed in terms of a nuclear H* peak followed by a trailing L tone. Furthermore, earlier I claimed that the second L tone in the full LH*L pitch accent is a "trailing L tone" of the pitch accent. The complication with my analysis so far rests in the fact that, given only the data and the pitch contours presented, there is another possible phonological way to view of the trailing low targets. The post-tonic elbow plus stretch of low level tone in the contour in figure 3.12, for instance, could alternately be analyzed as the phonetic manifestation of a low phrase accent. Phrase accents are a type of edge tone that demarcate intermediate phrases, a prosodic unit smaller than the intonational phrase. Low phrase accents are used extensively in some descriptions of declarative falling and interrogative falling-rising intonational contours in languages like German and English (Grice *et al.* 2000). In the case of the Lakota data, an L phrase accent analysis of trailing low targets is phonetically more compelling when one examines situations in which the unit that carries an H* nucleus is a polysyllabic word embedded inside longer and more complex intonational phrases. In such contexts, a clear low post-tonic target, or elbow, in the contour of the word sometimes aligns to a position that is at least two or three syllables distant from the H* carrying (stressed) syllable. This observation has two implications. The first implication is that the trailing L tone in H*L - if it is a trailing tone - seems to exhibit only a weak attachment to the nucleus of the pitch accent. The second consequence is that in order to entertain the possibility of an L phrase accent analysis of the post-tonic stretches of low tone - as opposed to a pitch accent trailing tone analysis - one has to examine phonologically complex intonational phrases in which different numbers of unstressed syllables are interspersed with primary and secondary stressed syllables. I briefly analyze these kinds of structures later in this chapter, in section 3.3.4,

when I discuss edge tones in Lakota intonational phrases. The presence of phrase accents is, as mentioned, directly related to the analysis of levels of prosodic structure. Therefore, I revisit the L phrase accent versus trailing tone issue, and attempt to clarify some of the associated analytical ambiguities, when I describe the prosodic phrasing of Lakota utterances in Chapter 4 (section 4.4).

3.3.3.4 The LH* Pitch Accent

Sometimes the pitch accent that appears on a major category word shows a somewhat clear leading L tone prior to the H* nucleus. In some of these cases the trailing L tone is absent. The simplest designation for these pitch accents is LH*. However, as already indicated in section 3.3.3.2 for the full LH*L pitch accent, the analysis of a leading L tone is problematic for many reasons. An H* peak by itself usually involves a local pitch rise from some mid or low level. A word with second syllable stress in phrase initial position, such as the word *čhaŋté* in example (16), will generally start at some mid level tone on the first, unstressed, syllable. Given that L tones at the beginning of utterances tend to be higher than L tones later in the utterance, how does one decide if this initial tone is some default mid-level starting point or an L tone target? I have indicated this uncertainty for the opening word in example (16) by transcribing the initial potential L tone in parentheses, (L), on the tonal tier in figure 3.13.

The analysis of leading L tones becomes even more complicated when consonantal onsets, such as glottal stops or voiced obstruents, are in word-initial position. These segments often cause dips in the pitch track (see figure 3.10), making the interpretation of a leading L target more ambiguous. Furthermore, voiceless consonants or consonant clusters at syllable onset interrupt the pitch trace and perturb the F0 value of the following vowel. Since voiceless syllable onsets are very common in Lakota, such phonetic interruptions are quite frequent. In such ambiguous instances I do not use the LH* pitch label. Instead, I designate the tonal prominence as either a simple H* or an H*L pitch accent, depending on what follows the peak.

Given the difficulties encountered with the leading L tones in Lakota, I have provisionally adopted the ToBI definition of the distinction between LH* and simple H* pitch accents. This definition states that the LH* differs from the H* primarily by a more significant rising pitch movement that leads to the H* peak. This definition still remains problematic for phrase-initial position, but at least it can be used in phrase-medial position if there is a clear pre-tonic syllable that carries the leading L of the LH* pitch accent.

3.3.3.5 Alignment of H* Peaks Relative to the Segmental Tier

An intonational phrase with multiple major category words can carry several H* pitch nuclei. In the one-word IPs discussed earlier, intonational peaks are realized within the boundaries of the lexically stressed syllable. This tonic alignment pattern also holds for both final and pre-final peaks in multiword IPs. Example (17) illustrates a three word, SOV, intonational phrase in which each major category word carries an H*L pitch accent. Note that each peak is aligned inside the temporal bounds of the corresponding stressed vowel.

(17) wakȟáŋheža =ki wówapi k'íŋ-pi
child =DET$_{def}$ book carry on back-pl
"The children carried books on their back." [Speaker DBW09:WE]

The F0 contour in figure 3.14 displays one obvious complication for the analysis presented so far. There is a downstepped peak on the definite article *=ki* that marks the subject noun. This peak occurs before the contour has reached the object noun, *wówapi*. The particle *=ki* is not a major category word and it is not perceptually stressed. For these reasons I have transcribed its peak as !H, without the * diacritic. The following noun, *wówapi*, carries an H* peak which is close to the level of the peak on *=ki*. The !H peak on *=ki* has properties similar to phrase accents in intonational phrase medial position. I discuss these phrase accents later, in section 3.3.4.

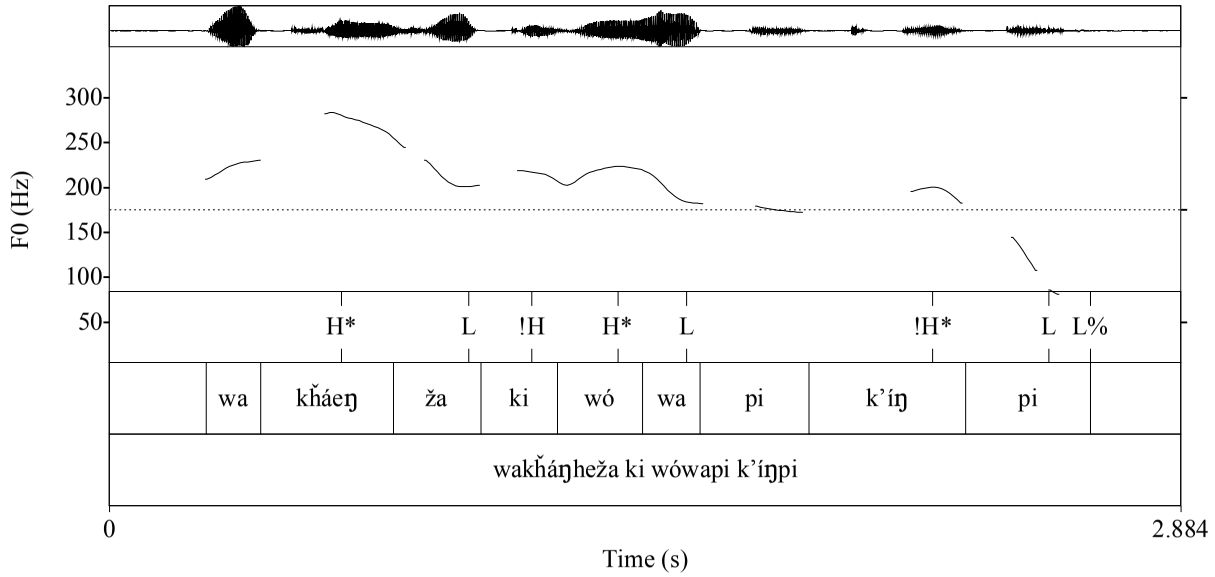


Figure 3.14: Lakota declarative SOV utterance in example (17), with H* peaks on each major category word. Note that all the pitch accent peaks display on-time alignment relative to the associated lexically stressed syllables.

The pitch accents in the declarative utterances show a very strong tendency toward on-time alignment of intonational peaks. Statistically, across all speakers, tasks, and genres, the on-time alignment of peaks is relatively robust. However, there are slight differences between speakers and between genres. Table 3.1 summarizes the alignment of F0 peaks for each speaker, across all tasks. Speakers PRS and SOF show 100% on-time alignment. Speaker DBW produced five cases of late peak alignment in the narrative tasks. Since the narrative part of the data subset contains 338 transcribed H* peaks, this means that only 1.5% of all the pitch accents in all the narratives show late alignment. In the scripted conversations and elicitation tasks, late alignment is slightly more frequent; in these tasks speaker DBW produced 5.3% of the peaks with late alignment.

Narratives	Number of H*s Analyzed	Number of Late F0 Peaks	% Late
DBW06	107	2	1.9%
DBW09	94	3	3.2%
SOF73	71	0	0.0%
PRS73	60	0	0.0%
Elicited and Scripted Data			
DBW09E	26	1	3.8%
DBW09S	61	2	3.3%
DBW09SC	26	3	11.5%

Table 3.1: Alignment of F0 maxima in declaratives. Late F0 Peak indicates temporally late alignment relative to lexically stressed syllable.

As shown by the token counts in table 3.1, there are just a handful of declarative phrases in which an H* pitch accent nucleus appears to be aligned late relative to the stressed syllable. In the scripted conversations and elicitations the late peaks happen relative to both first and second syllable stress, in both simple and complex syllable contexts. Of the five cases of late alignment in the narratives, one occurs in a word with first syllable stress and four occur in words with second syllable stress. The word with late alignment relative to first syllable stress has a morphologically complex onset, *wó-*. One of the words with late alignment relative to second syllable stress contains an initial vowel-vowel sequence. This token of late alignment is displayed in figure 3.15. In this figure, corresponding to example (18), the H* accentual peak on the adverb *oíyokiphiya* seems to be phonetically aligned at the beginning of the unstressed third syllable *yo*. However, the apparent late alignment of the accentual peak on *oíyokiphiya* in example (18) is ambiguous

for several reasons. First, the segmental boundary between the high front vowel [i] and the semi-vowel [y] is inherently difficult to define. This is especially true when an [iy] sequence is uttered at relatively fast speech rates.[7] One could argue, therefore, that the apparent late alignment in example (18) is simply a case of segmentation ambiguity in a fast speech rate context. Additionally, the duration of the word initial [oí] sequence in this example is only 130 milliseconds; this is relatively short temporal space for the utterance of two vowels that belong to separate syllables. As a result of this temporal crowding of segments, the [i] vowel of the word-onset sequence perceptually appears to be reduced to a point of near-deletion. This gives rise to an apparent late alignment because the associated H* peak - which resides in the locally sparsely populated tonal tier - survives and docks onto the next available syllable, [*yo*].[8]

(18) čha oíyokiphi-ya leháηl wa-'úη
so happy-advz these days$_{ADV}$ 1.sg.agt-live
"So, now I live joyfully." [Speaker DBW09:N]

In most of the cases of late alignment, the main part of the rise toward the peak takes place during the stressed syllable. The peak is then reached in different parts of the post-tonic syllable, depending on what the segmental makeup of the onset of that syllable is. In three of the cases of late alignment, the F0 track is interrupted by the voiceless consonant at the onset of the post-tonic syllable. The transition to the peak is thus difficult to inspect in a measurable way. Example (19) illustrates one case of these disrupted late alignments. The late alignment here occurs on the initial adverb, *tókhiyataη*, "from somewhere".

(19) tókhiyataη áta iyéčhiηkiηyaηke =waη hi-nážíη čha
whence$_{ADV}$ entirely car =DET$_{indef.real}$ arrive-stand so$_{CONJ}$
"From somewhere a car appeared, so ..." [Speaker DBW09:SC]

[7] In example (18), the speaker produces a rate of nearly 7 syllables per second in the vicinity of the word *oíyokiphiya*.
[8] See section 3.3.3.7, example (23), for a brief discussion of contexts with *tonal* crowding.

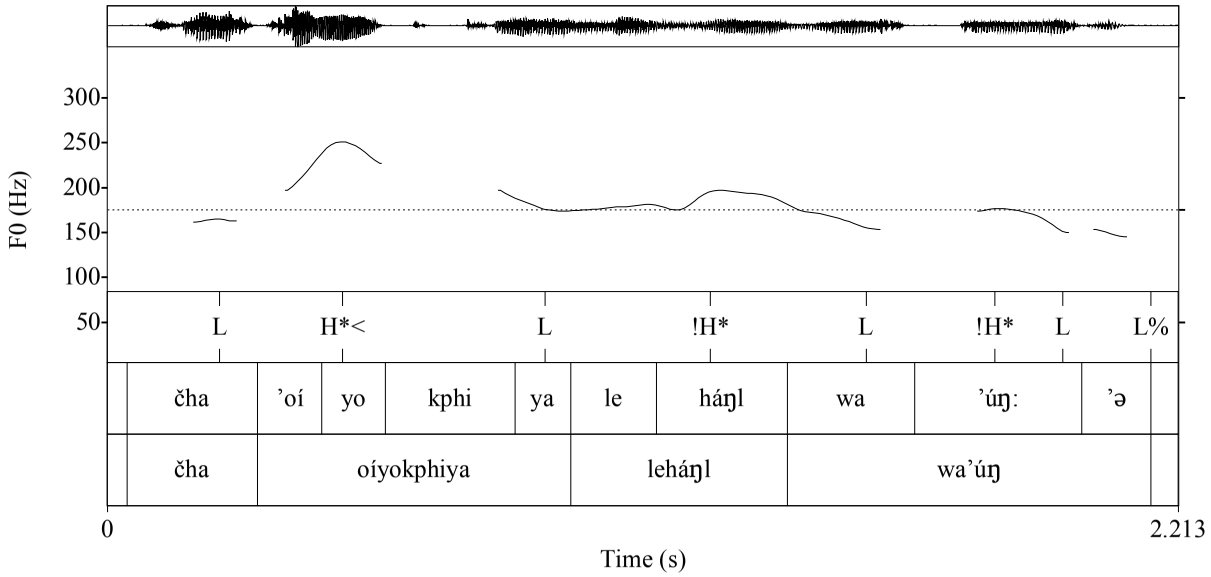


Figure 3.15: Slight late alignment of H* peak on the adverb *oíyokiphiya* in example (18). This case of apparent late alignment could alternatively be attributed to (a) the segmentation ambiguity between [i] and [y] in the word initial *oíyo* sequence, and (b) the near-deletion of [i] due to temporal crowding of segments in fast speech rates.

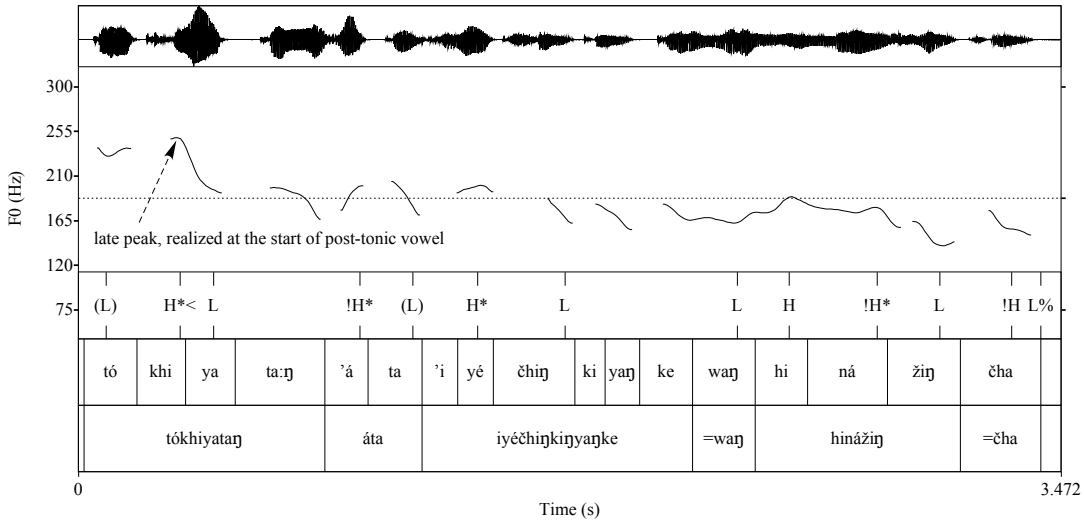


Figure 3.16: Disrupted late alignment on the IP-initial adverb *tókhiyataŋ* in example (19).

Despite the low rate of late alignments, there is one very interesting observation to make from the data. These late peaks tend to occur either on nouns or on adverbs. Upon closer inspection I discovered that almost all these late alignments are either (a) on words in IP-initial position or (b) on words that are preceded by a phrase accent in IP-medial position. Overall, there are so few of these late peak alignments that I cannot make any strong generalizations. They can even be ignored without altering the intonational analysis of declaratives presented here. However, I will revisit this issue again for interrogative utterances, in sections 3.5.3 and 3.5.4, where it appears that late peak alignment is much more frequent.

3.3.3.6 The H*HL Pitch Pattern

In addition to the maximal core LH*L pitch accent, a small subset of the declarative data contains tokens of major category words with a pitch pattern that can, at least phonetically, best be described as an H*HL sequence. Meaning, the pitch accent exhibits a post-tonic peak or high plateau before a sharp drop to the low trailing tone. The H*HL sequence appears to be used in the declaratives that were obtained in the narrow/broad focus elicitation and scripted conversation tasks (see section 2.3.1). Figure 3.17 shows the pitch track for the declarative utterance in example (20), with elicited narrow focus on the subject

wičhíŋčala, "girl". The H*HL pattern is absent from the same nouns in declaratives elicited with a broad or predicate focus reading.

(20) wičhíŋčala =ki wačhí-pi =kštó

girl =DET$_{def}$ dance-pl =decl$_{assert}$

"The GIRLS danced." [Speaker DBW09:SC]

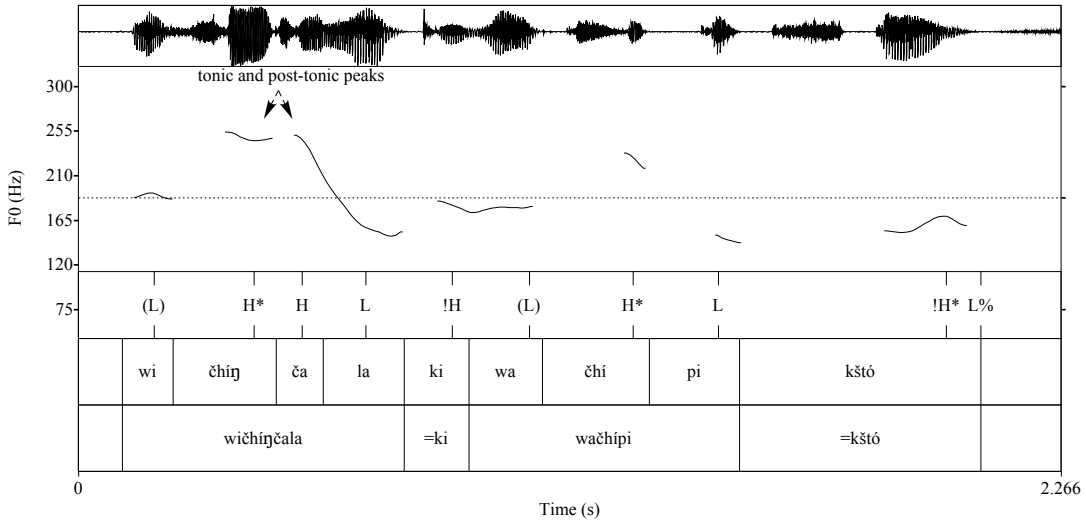


Figure 3.17: Post-tonic H tone on the narrow focused subject NP in example (20).

It is important to note that, in Lakota, a special morpho-syntactic construction does exist to mark a noun, a verb, or a phrase as "emphatic" (Rood & Taylor 1996:456). The article *čha*, which also functions as a relativizer, is frequently used to mark a constituent as emphatic. Example (21), from Ullrich (2008:757), illustrates the use and meaning of three different post-nominal articles.

(21)

	Lakota Phrase	*Gloss*
a.	Hokšíla waŋ héčhuŋ	"A boy did that."
b.	Hokšíla kiŋ héčhuŋ	"The boy did that."
c.	Hokšíla ča héčhuŋ	"It was a boy who did that."

In the subset of declaratives with elicitation for contrastive noun focus, *ča* is always used with the contrasted noun. In addition, some of the narrow focus elicited nouns are also marked with the article *ča*. In these sentences, the H*HL pattern occurs on the contrastive or narrow focused noun most of the time. Example (22) shows a clip from one of the scripted conversations in which an object noun, *hayápi*, "clothes", was contextually narrow focused. This noun occurs with the article *ča* and carries an H*HL pitch pattern, as can be seen from the contour in figure 3.18.[9]

(22) Chuck hayápi ča otúȟ'aŋ

Chuck clothes DET_{rel} donate

"Chuck donated clothes." *or* "It was some clothes that Chuck donated." [Speaker DBW09:SC]

From the small sample of elicited and semi-spontaneous declaratives with various focus types, it appears that the pitch pattern H*HL is used in conjunction with the lexical subject or object NPs. Here I, provisionally, analyze the H*HL as a pitch accent type with a limited distribution. A piece of evidence in favor of the existence of this pitch accent comes from interrogative utterances, which I discuss later in section 3.5. However, there are several reasons to doubt the analysis of H*HL as a pitch accent type. The analysis I have provided here is phonetically complicated by several cases of voiceless onset consonants in the post-tonic syllable. These consonants disturb the pitch track, making the intonational status of the post-

[9] Like the other pitch accents discussed earlier, the H*HL can have downstep. In figure 3.18, the noun *hayápi* actually shows a !H*!HL sequence.

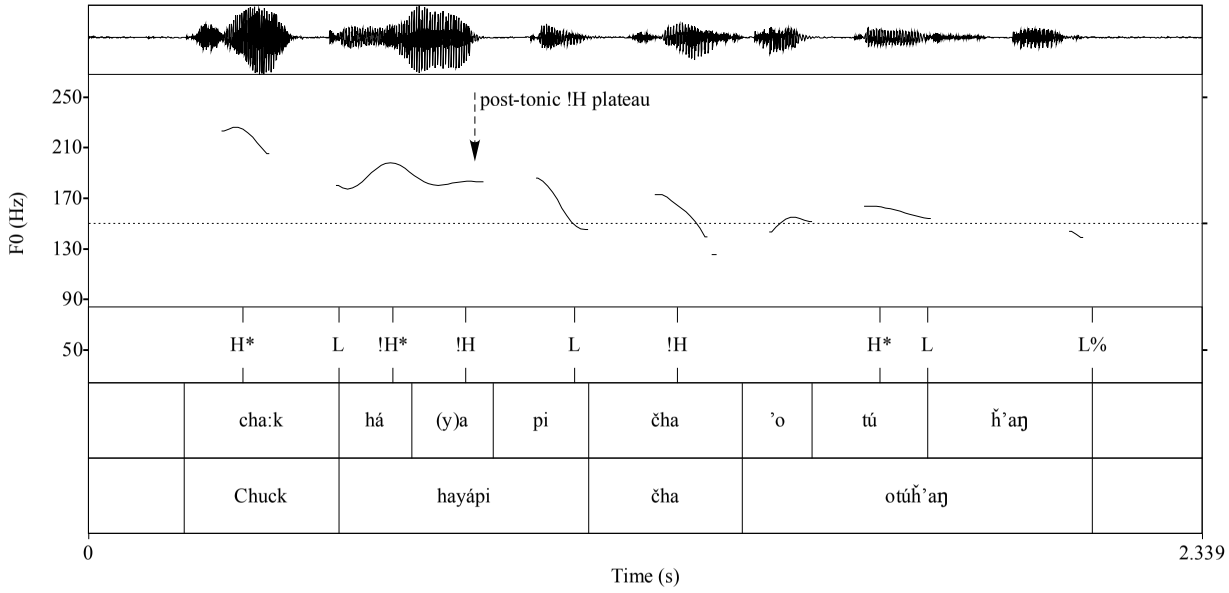


Figure 3.18: H* pitch accent plus post-tonic !H tone on the narrow focused object NP in example (22). Note that the object NP is also marked with the article *ča*.

tonic H difficult to assess. This is especially true at faster speech rates. In addition, some of the H*HL cases without downstep on the post-tonic H phonetically resemble a peak with a rather broad width. Whether these peaks should be analyzed as a single, broad-band, H* or an H*H needs further investigation. I do not pursue this topic any further here.

3.3.3.7 Effect of Tonal Crowding

In multi-word IPs, two consecutive H*L pitch accents can be temporally very close together. This could happen, for instance, if the first word in the IP is a two syllable word with second syllable stress and the following word has first syllable stress. If each stressed syllable caries an H*L pitch accent, then these tonal events get crowded into a small temporal space. In such high tone-pressure circumstances the L tone in between the two H* pitch accent nuclei may be undershot. Figure 3.19, corresponding to example (23), displays a phrase in which the potential L tone target between two adjacent words appears to be undershot.

(23) ešá míla waŋží bluhá=šni

I wish$_{ADV}$ knife one$_{hyp}$ 1.sg.have=neg

"Oh, I wish I had a knife." [Speaker DBW09:E]

This contour can be compared to the one in figure 3.14, where overcrowding has not taken place and the L tone after the first H* is fully realized. The undershoot of L tones in complex LH*L pitch accents is probably also a function of speech rate. However, I have not explored this dependence in the current study.

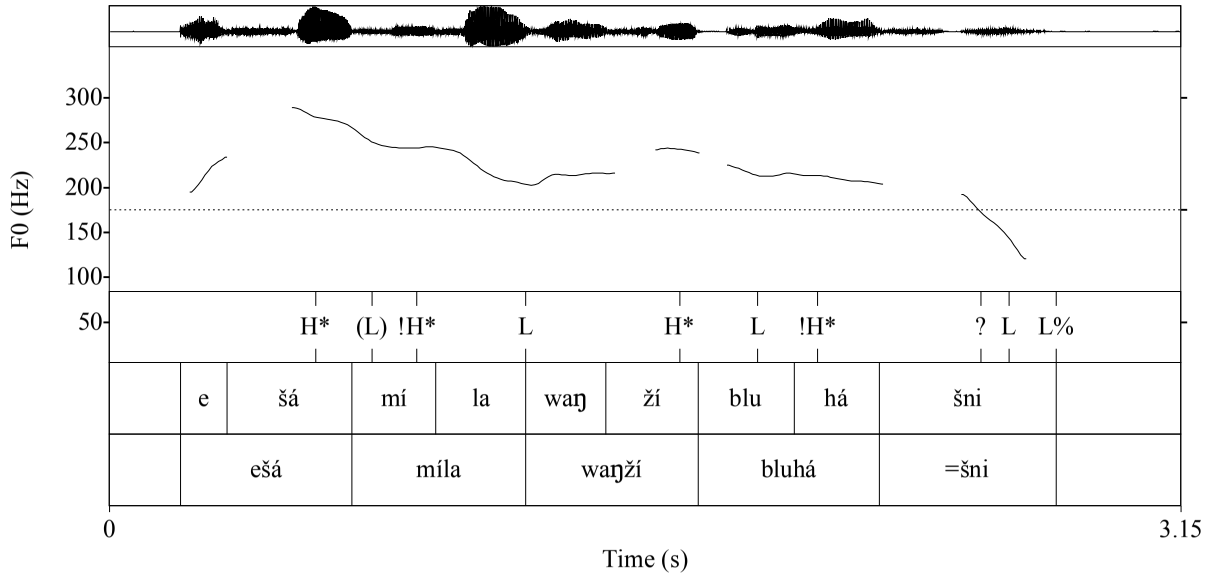


Figure 3.19: Tonal crowding between the first two accent bearing words, *ešá* and *míla*, in example (23). In the context of this tonal crowding the low valley between the two H* peaks is undershot.

3.3.3.8 Phonetic H on Unstressed $C_{[-voice,-cont]}V$ Word-Onset Syllables

In some cases the accentual peak of the stressed second syllable of a word is preceded by a leading high, or near high, F0 plateau on the first (unstressed) syllable. A trailing L tone is usually present in these contexts. Phonetically, such tonal movements have the shape of an HH*L sequence. Unlike the root LH*L pitch accent, the HH*L tone is relatively easy to discover in the data. When the HH*L sequence occurs in a one word intonational phrase, the speaker starts the utterance at a high pitch on the first syllable. The pattern is especially clear when the single word in the phrase is polysyllabic with second syllable lexical stress. Figure 3.20 shows the pitch track for the three syllable, one word, intonational phrase shown in example (24).

(24) khiyéla

nearby$_{ADV}$

"Nearby." [Speaker DBW09:WE]

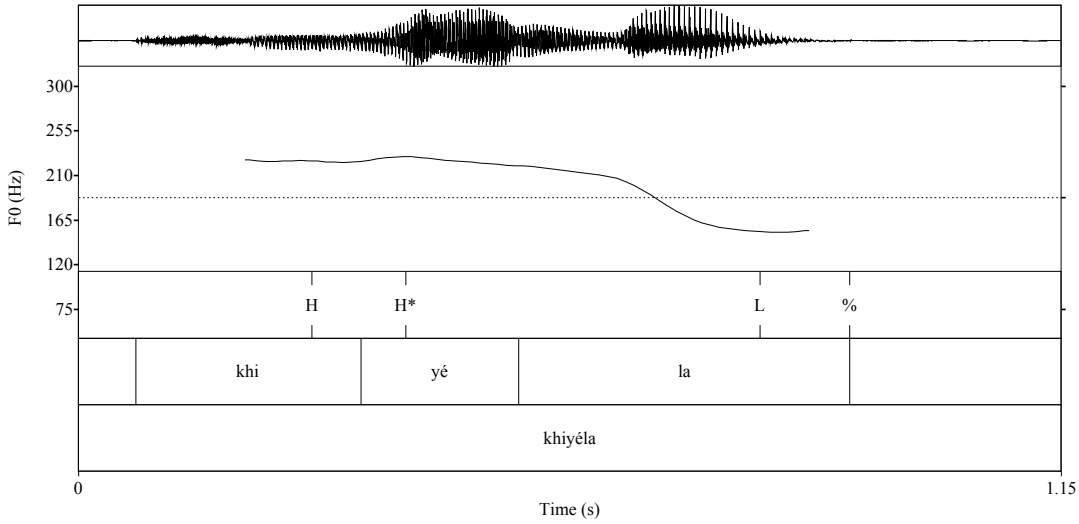


Figure 3.20: One word intonational phrase exhibiting a surface HH*L tonal sequence; example (24).

The HH*L sequence is not limited to one word intonational phrases, nor is it limited to phrase initial position. It can occur inside longer phrases, as shown in example (25). In this utterance the second word carries an HH*L pitch, as seen in figure 3.21. Notice that the first H in this sequence is the location where downstep occurs.

(25) naháŋȟči kiŋyáŋ-pi =šni

yet$_{ADV}$ fly-pl =neg

"They cannot fly yet." [Speaker DBW09:S]

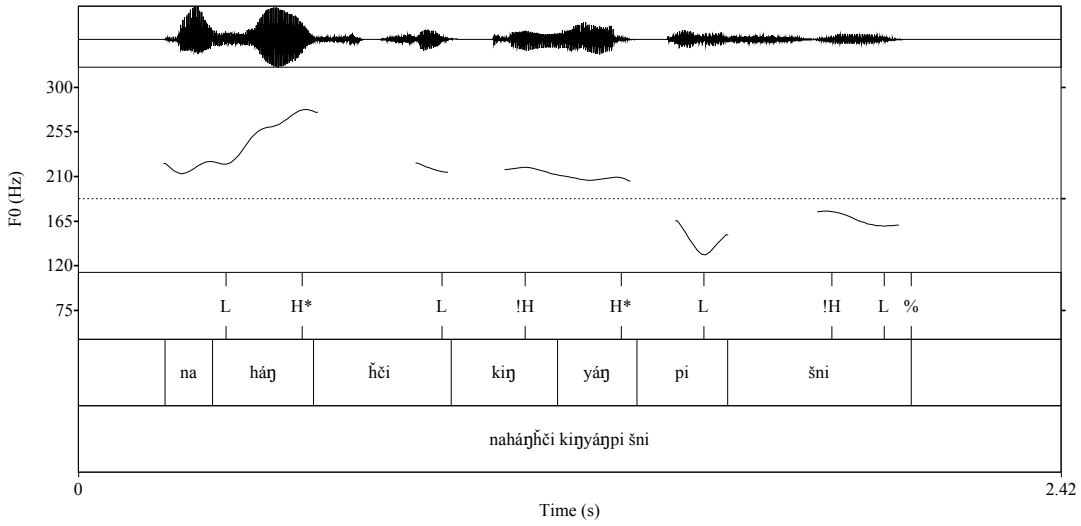


Figure 3.21: Phrase medial HH*L tonal sequence on the verb in example (25).

In my analysis here I do not consider the HH*L sequence as a pitch accent in declaratives, however. This is mainly because the distribution of the tonal sequence HH*L is very limited in the data. In almost all the observed tokens the pre-tonic H occurs only on particular types of unstressed syllables in word onset position. More specifically, the word initial syllable in these contexts is CV, where C is an aspirated or plain voiceless stop. Since other types of onset consonants start at mid or low tones, I have, provisionally, treated the H in the HH*L sequence as a phonetic H tone that is triggered by plain and aspirated voiceless stops. I

hypothesize that the core pitch accent in these contexts is H*L. I would need more data specifically tailored to address this tonal pattern in order to test this hypothesis.

3.3.3.9 De-Accenting: Major Category Words without H* Peaks

In some declarative tokens there are phrase final, major category words that appear without a significant pitch peak. When phrase-final corresponds to utterance final these de-accented words are almost always the final verbs (recall that Lakota sentences are predominantly verb-final). An example of a de-accented verb in final position is illustrated in figure 3.22. The verb *waŋbláke*, "I saw", seems to carry a very small pitch peak, but the pitch span is so compressed that it is difficult to judge its tonal prominence. Since the pitch reaches an L tone at the end of the noun and comes back up slightly over the entire verb word, I have labeled the post-nominal tonal sequence with a !H, starless, accent.

(26) wakȟáŋheža =waŋ waŋbláke

child $\text{DET}_{indef.real}$ 1.sg.agt-see

'I saw a child.' [Speaker DBW09:E]

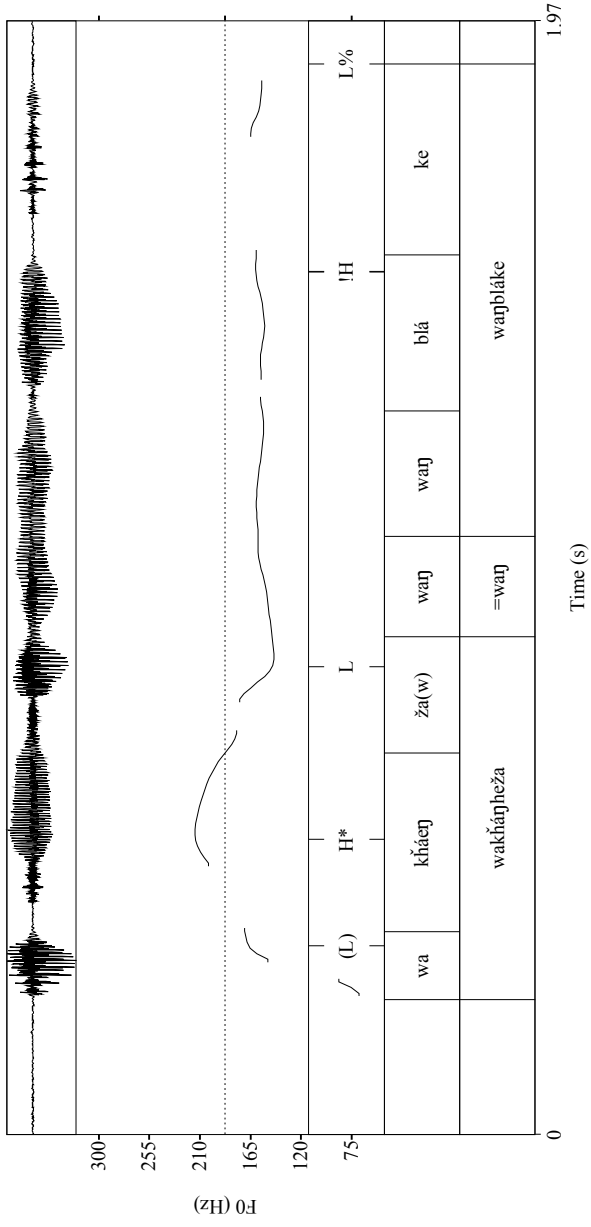


Figure 3.22: De-accenting of the final verb in the OV sentence in example (26). Note the sudden pitch span compression after the object noun phrase.

Interestingly, in most of these peak-less words there is still a perception of dynamic stress on the strong syllable of the word. This is especially true if the de-accented word is a major category word. In example (26), one can still hear the stress on the second syllable of the verb (*.blá.*), despite the compressed pitch range. This observation supports the notion that Lakota is a lexical stress language. Pitch accents, when present in the tonal tier, often accompany and align with lexical stress, but syllabic strength is not always directly correlated with large tonal movements.

De-accenting also takes place on adverbs and conjunctions in certain kinds of phrase final positions. The demonstrative adverb *hená*, "them, those there", and the conjunction *naháŋ*, "and, and then", often occur at the ends of phrases in the narratives.[10] Such items are frequently used to connect pieces of information together. At such points in the utterance the pitch span is often compressed and these adverbs and conjunctions display a flat mid or low pitch, despite being lexically stressed. Example (27) contains a token of a de-accented conjunction, *naháŋ*, in intonational phrase-final position. This de-accenting manifests as an extended span of low pitch over the length of the word. The extreme flatness of the pitch during the final portion of the utterance can be easily observed in the F0 contour in figure 3.23.

(27) mas'óphiye =waŋ él inážiŋ-pi naháŋ

store $\text{DET}_{indef.real}$ at_{PP} go.and.stop-pl and_{CONJ}

"They stopped at a store and ... " [Speaker PRS73:N]

Such extended spans of low, compressed pitch range display qualitative similarities to the types of tonal events described as "phrase accents" in the literature on intonational phonology (Ladd 2009:101-102). I pursue this connection further in the next section, where I analyze the edge tones in Lakota declaratives.

[10] "Phrases" here refers to intonational and intermediate phrases, defined more precisely in sections 3.3.4 and 4.4.2.

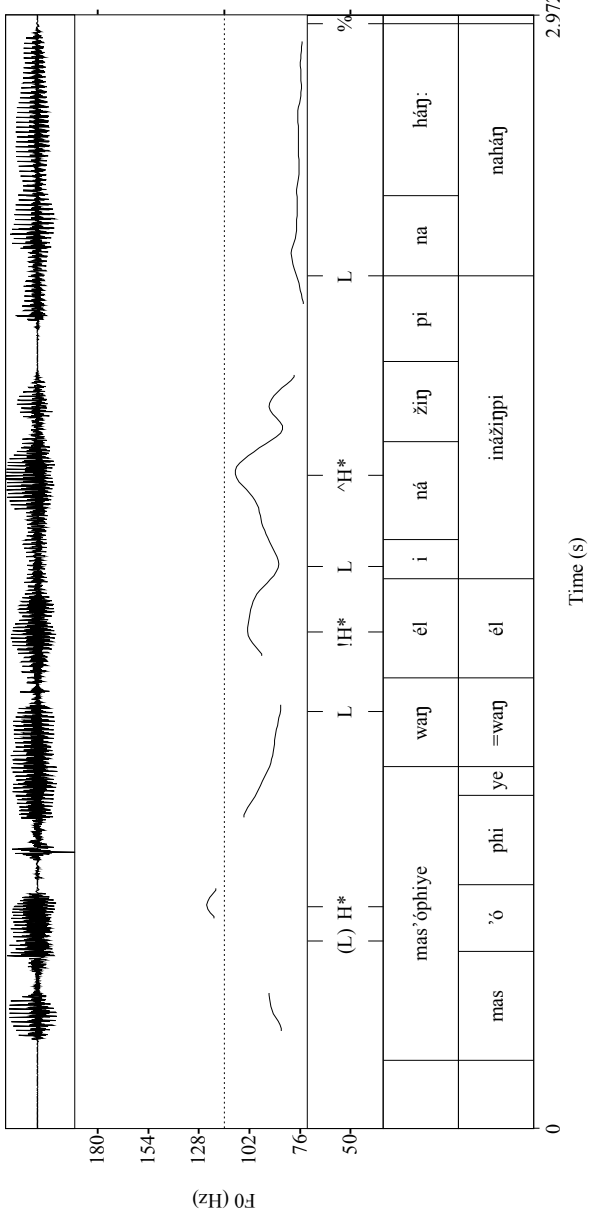


Figure 3.23: De-accenting of the conjunction *nahá*ŋ in intonational phrase-final position. Note the sudden pitch span compression after the verb.

3.3.4 Edge Tones in Lakota Intonational Phrases

In this section I summarize the types of edge tones in Lakota intonational phrases. The analysis presented here is solely based on the declarative data subset described in section 3.3.2. However, as I will show later, these edge tones are used in other modalities as well. The results of my analysis here are presented as follows. First, I provide a description of the types of boundary tones that occur at the right terminal edges of declarative utterances. Next, I argue in favor of a phrase accent analysis of certain kinds of tonal events that occur either right before the boundary tone or, sometimes, in the middle of an intonational phrase.

3.3.4.1 Boundary Tones

Most of the Lakota declarative intonational phrases in the dataset end with a final low boundary tone, transcribed as L%. Phonetically, the L% boundary tone manifests as a final drop to the bottom of the speaker's range on the very last syllable of the last word in the intonational phrase. Often, but not always, the fall is accompanied with creaky phonation. Most of the declarative intonational phrases discussed in section 3.3.3 show an L% boundary tone at the end. This is particularly clear in figure 3.14, for instance, where the speaker makes a sharp drop to the bottom of her range on the last syllable *pi*. Following the intonational phrase boundary tone there is usually, but not always, a pause. The speaker then starts the next phrase with pitch and declination reset.

Figure 3.24 shows the pitch track for the declarative sentence in example (28). Notice the drop in pitch on the final syllable of the verb, in clause final position. The last vowel [e] is also glottalized, as indicated in the transcription in the syllable tier.

(28) pahátakiya napé kóze

toward the hills$_{ADV}$ hand wave

"He waved his hand toward the hills." [Speaker DBW09:E]

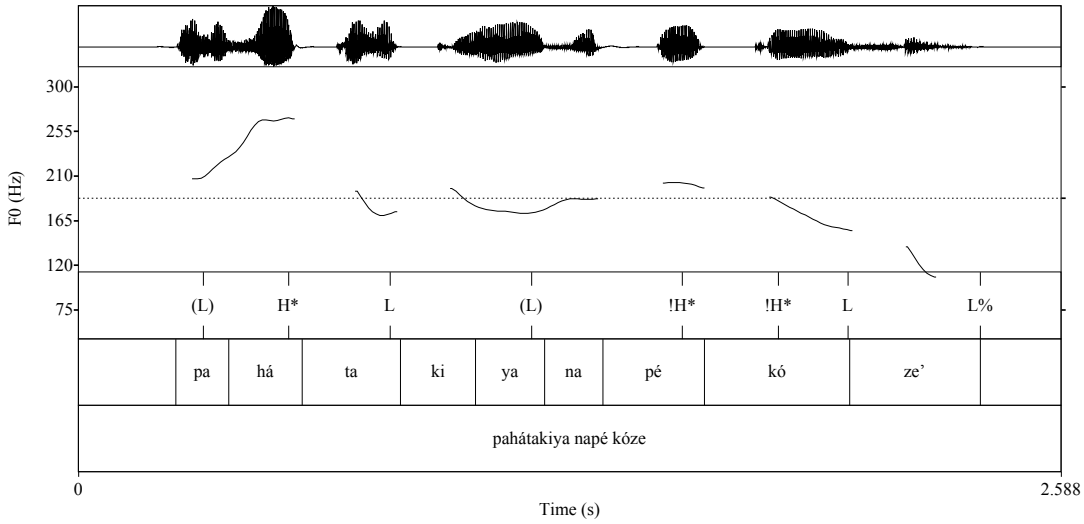


Figure 3.24: The L% boundary tone, realized as a final drop on the last syllable of the verb; example (28).

The final glottalization that accompanies the L% boundary in example (28) is reminiscent of the observation made by Boas & Deloria (1941) concerning the declarative glottal stop (see section 3.3.1). The declarative dataset analyzed here does give some support to Boas and Deloria's observation. Many of the L% boundary tones examined are accompanied by a final glottal stop. For speaker DBW the final declarative glottal stop sometimes causes an echo vowel to appear at the very end; that is, the last vowel is glottalized and in post-glottal position a devoiced copy of the vowel can be heard. It is important, however, to distinguish the final glottal stop from the L% tonal boundary event. Although the declarative glottal stop generally occurs only with the L% boundary tone, not all L% boundary tones have an accompanying glottal stop.

The ends of declarative utterances in the data do not always display a drop to the bottom of the speaker's range. Sometimes the F0 contour at the end of declaratives is a continuing flat low pitch that shows no significant movement on the last syllable of the phrase. In such situations I have, tentatively, transcribed the level IP-final plateau as underspecified % boundaries. Example (29) is one of the tokens of the underspecified boundary. In the corresponding F0 trace in figure 3.25 there is no significant tonal movement on the last syllable of the phrase.

(29) wičháša =ki wakhúl-iyáya-pi

man =DET$_{def}$ shoot-set.out-pl

"The men had gone out hunting." [Speaker DBW06:N]

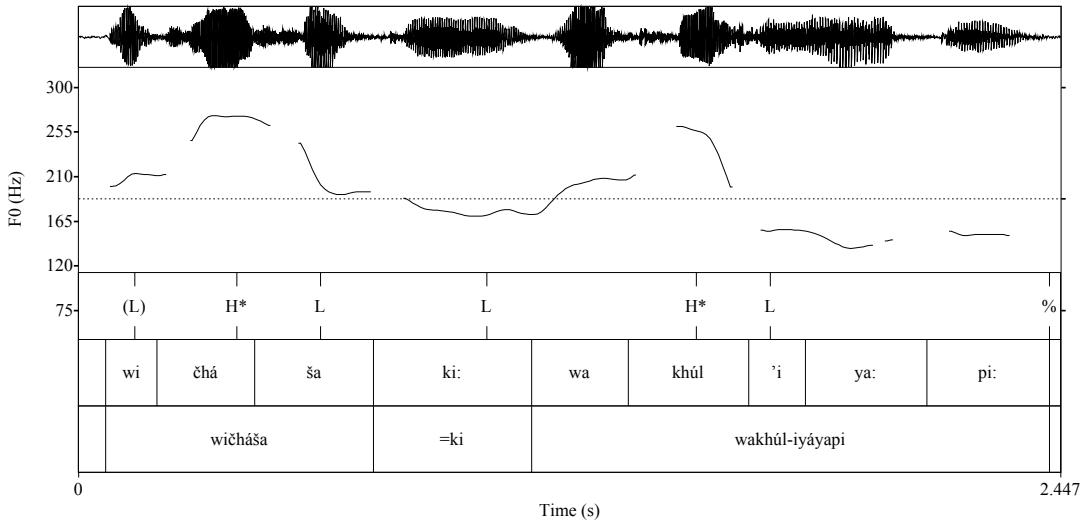


Figure 3.25: The underspecified % boundary tone, realized as a continuous flat plateau on the IP-final syllable; example (29).

There are two important observations to mention regarding the % boundary tone. Sometimes the pitch track at the end of the intonational phrases makes low level, extremely compressed pitch range, oscillations on the last syllable. Based on impression, there is no clear audible low or high boundary at these ends. I have used the underspecified % boundary in such situations as well. The second important observation is that in the tokens with % boundary the declarative final glottal stop is completely absent.

A small portion (about 2.3%) of Lakota declaratives in the narrative genre show a fall followed by a slight rise at the very end of the intonational phrase. I analyze the edges of these intonational phrases with downstepped high boundary tones, !H%, to distinguish them from both the complete L% fall and the flat, underspecified, % boundaries. The !H% generally consists of a very small final rise that does not go above the preceding last H target (either the last pitch accent or the last phrase accent) inside the intonational

phrase. Figure 3.26 shows the pitch track of a declarative phrase in which there is a slight final rise on the very last syllable of the verb.

(30) na makȟóče =ki oíyokiphi

and$_{CONJ}$ land =DET$_{def}$ happy

"And the land was very pleasant." [Speaker DBW09:E]

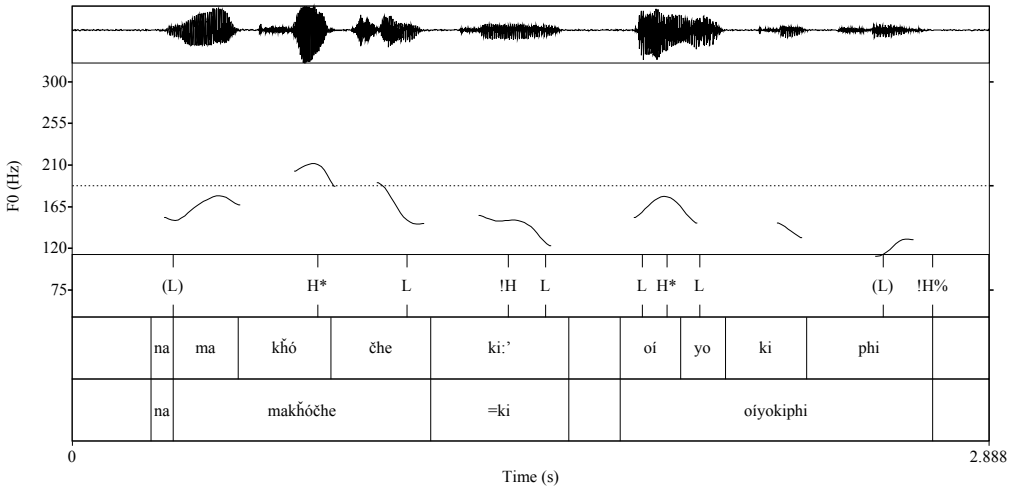


Figure 3.26: The declarative downstepped boundary tone !H%, realized as a small rise on the last syllable of the final verb; example (30).

In some contexts, the analysis of the !H% boundary tone is phonetically problematic because there is another type of IP-final tonal sequence that can display similar F0 characteristics. It is possible for the final portion of an intonational phrase to consist of a pre-final !H* pitch accent, or a !H phrase accent, followed by an underspecified boundary tone. In such circumstances, the resulting final tonal sequence is [!H* %] or [!H %]. If the speech rate is moderate to fast, this tonal sequence will usually realize in a way that is phonetically very similar to a !H% boundary tone. A [!H* %] tonal sequence frequently occurs when, for instance, certain outer layer, accented, enclitics follow the final verb (see analysis and discussion in section 4.5).

A summary of the frequency of occurrence of the three boundary tones in declaratives is shown in table 3.2. Notice the relative low rate of occurrence of the !H% boundary tone in this data subset. The underspecified % boundary tone occurs more often, but it is not as frequent as the L%. As I show later, in section 3.5.3, the underspecified % boundary is much more frequent in yes-no interrogatives.

Narrative Data	Number of L%	Number of %	Number of !H%
DBW06	18	7	0
DBW09	20	4	1
SOF73	13	4	1
PRS73	13	5	0
Frequency:	74.4%	23.3%	2.3%
Elicited and Scripted Data			
DBW09E	10	4	0
DBW09S	17	3	0
DBW09SC	4	1	0
Frequency:	79.5%	20.5%	0.0 %

Table 3.2: Frequency of occurrence of L%, %, and !H% IP boundary tones in the declarative database.

3.3.4.2 Phrase Accents

At the outset of this investigation I had hypothesized that Lakota was primarily characterized by pitch accents and boundary tones, and that the issue of a phrase accent was not relevant for this language. After analyzing the data carefully, it now appears that my original hypothesis was wrong; there is very good evidence for a phrase accent analysis in Lakota. Earlier, in section 3.3.3.3, I entertained the possibility of positing an L phrase accent in order to account for the observed variations in the alignment of the trailing L tone in H*L pitch accents. Further data analysis has revealed that there are other types of edge tone events in Lakota utterances that show properties of phrase accents. These phrase accents appear in all the genres of narratives considered in this study. They are used frequently and seem to play a significant function in the flow of the discourse. In this subsection I describe several types of observable F0 trace events in Lakota utterances which are best analyzed as phrase accents. I distinguish these edge tone events from pitch accents and discuss the relation between them at some length.

The phrase accent in Lakota varies in its realization. Sometimes it is very obvious in the tonal contour. At other times it is somewhat subtle to analyze. In the current analysis I have posited three types of phrase accents in the declarative utterances. There are two single tone phrase accents: a low, L, phrase accent and a downstepped high, !H, phrase accent. The third type of phrase accent is a complex structure which shows a long rising pattern that starts low and ends high. I designate this third type of phrase accent as LH. The simple phrase accents, L and !H, are used very frequently in the narratives and semi-spontaneous speech, by all three speakers. The complex phrase accent, LH, has a more limited distribution and occurs mainly in the narratives told by the women speakers DBW and SOF. Among these, it is used more frequently by speaker DBW.

A distinguishing feature of all three phrase accents (L, !H, and LH) is that they generally correspond to a *stretch* of contour, rather than a single F0 maximum or minimum. This observation is in agreement with the general properties of phrase accents pointed out, for instance, by Pierrehumbert & Beckman (1988). In addition, each type of phrase accent displays particular association and alignment relationships relative to the segmental material with which it occurs. I describe each phrase accent below, using some example phrases form the data. In each case I also briefly discuss some of the corresponding tune-text association patterns observed in the data.

The L Phrase Accent

Example (31) shows a long intonational phrase from the narrative by speaker PRS. The pitch contour in figure 3.27 displays two long stretches of flat low tone that are labeled with arrows. I analyze these as the phonetic representations of low phrase accents. As seen in figure 3.27, the two L phrase accents appear in the F0 contour as stretches of low tone that start from the elbow of the preceding pitch accents and stretch over several post-tonic syllables, until another intonational event takes place. The words that carry the L phrase accents are almost completely de-accented.

(31) mas'óphiye yuhá-pi =ki hená o-wíčha-yuspa-pi naháŋ

store have-pl =DET$_{def}$ them$_{DEM}$ pl.anim.pat$_{infix}$-seize-pl and$_{CONJ}$

"The store owners, they, they seized them and so ... " [Speaker PRS73:N]

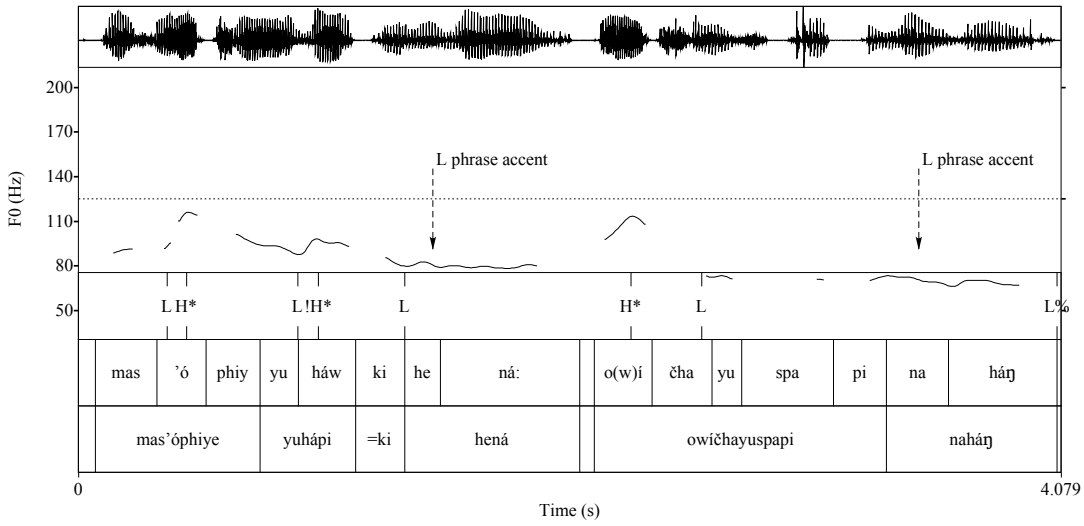


Figure 3.27: Analysis of long flat low tones as L phrase accents inside the Lakota intonational phrase in example (31).

In phrase final position the L phrase accent is usually carried by "de-accented" verbs, adverbs, demonstratives, or conjunctions. In example (31) the first L phrase accent stretches over a demonstrative and the last one stretches over a conjunction. However, if the pitch range on the final verb, adverb, or conjunction in the utterance is not compressed, the lexically stressed syllable on these words usually carries an H*L pitch accent, as described in section 3.3.3. In such circumstances the L phrase accent appears as a simple continuation from the trailing tone of the last pitch accent to the end of the phrase.

Based on these observations, there are two transparent ways to describe the association properties of the L phrase accent. One possible analysis is to associate the L phrase accent with a particular syllable and to account for the longer, flat stretch of the phrase accent in terms of tone spreading. Under such an analysis, the L phrase accent can be said to associate *either* with the immediate post-nuclear syllable *or*

with the syllable at the end of the phrase. The long stretch of phrase accent is then a result of *either* the right spreading of an immediate post-nuclear L tone to the end of the phrase *or* the left spreading of a final phrasal L tone to the previous (i.e., last) pitch accent. Another possible analysis is to claim that L phrase accent displays multiple linking to two locations in the post-nuclear stretch of the utterance. The first linking location is the immediate post-tonic syllable of the last pitch accent and the second linking location is the last or next-to-last (penultimate) syllable of the phrase. The F0 contour in-between these two ends can then be described in terms of phonetic interpolation. Such a "double" association of the L phrase accent, and the in-between interpolated stretch, is inferable from the F0 contour portions labeled as "phrase accents" in figure 3.27. A multiple linking analysis of the Lakota L phrase accent is similar - although not identical - to the secondary association of phrase accents in the question tunes of several Eastern European languages, as discussed by Grice *et al.* (2000).

In the current study, I have not conducted any phonetic alignment or contour slope experiments that would guide me to choose either the spreading or the multiple linking analysis for the L phrase accent. However, the association properties of the !H and LH phrase accents - which I discuss below - seem to indicate that a multiple linking analysis is probably more preferable for phrase accents.

The !H Phrase Accent

In some declarative tokens the trailing L of the last pitch accent is followed by a slight rise back up to a new, downstepped, high level that stretches all the way to the terminal boundary tone. The stretch of downstepped high tone that starts after the trailing L tone of the last pitch accent and reaches to the boundary tone has the same type of flat characteristics as the L phrase tone, except that it is higher than the last, previous low in the utterance. I analyze these slightly raised final stretches as !H phrase accents. The !H phrase tone is sometimes difficult to observe in phrase medial position. It is most transparent when it occurs right before the terminal boundary tone of the intonational phrase. Figure 3.28 shows the pitch track of the declarative token in example (32). The stressed syllable of the clause-final verb is followed by three unstressed syllables before the end of the intonational phrase is reached. Notice that the trailing L

tone of the last pitch accent is followed by a rise to a new downstepped high plateau. The downstep feature of the phrase accent here is defined relative to the previous highest peak.

(32) waŋblí eyá waŋ-wíčha-blake

eagle some$_{DET}$ pl.anim.pat$_{infix}$-1sg.agt.see

"I saw some eagles." [Speaker DBW09:E]

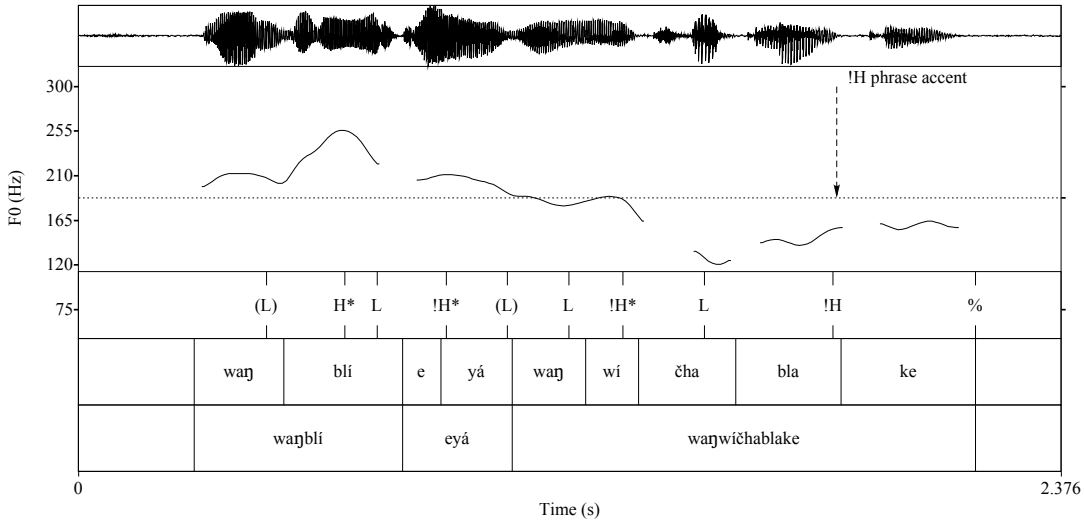


Figure 3.28: The !H phrase accent before a % IP-boundary. The trailing L tone of the last pitch accent in the phrase is followed by a rise to a new downstepped high plateau; example (32).

The association properties of the !H phrase accent are somewhat more transparent than those of the L phrase accent. One of the outstanding features of the !H phrase accent is that it prefers to dock onto a *stressed* post-nuclear syllable, if such a syllable is available. This happens when a stress-bearing major category item (i.e., a verb, an adverb, or a conjunction) carries the phrase accent. In addition, the !H also seems to link to the ultimate or penultimate syllable of the phrase to which it belongs. As in the L phrase accent, the F0 contour in between the stressed post-nuclear syllable and the last syllable of the phrase can be described by phonetic interpolation. The !H phrase accent is thus (a) attracted to a stressed post-nuclear

tone bearing unit, and (b) attached the end of the phrase. These facts imply that the association of the !H phrase accent is better described in terms of multiple linking with the segmental material.

The LH Phrase Accent

The third type of phrase accent that appears in the declarative data is a rising, LH, pattern. This type of phrase accent is most transparent when it occurs inside long utterances that contain embedded clauses. Structurally, the phrase accent is characterized by a steady rise that starts with the trailing L tone of a pitch accent and links to the H* of the following H*L pitch accent. It can span several post-tonic syllables, crossing word boundaries in some contexts. Figure 3.29 shows the pitch track of the complex clause in example (33). The contour for this sentence displays an IP-medial LH phrase accent, the start and end points of which have been labeled along the F0 contour in figure 3.29. The beginning of the LH phrase accent is linked to the trailing tone of the H*L pitch accent on *wóoglakapi*.[11] The rising sequence ends with a high tone that establishes the H level for the next H*L pitch accent on *héčha*.

(33) eháni wóoglakapi héčha čha o-wá-glakiŋ =kte

long.ago story$_{nomz}$ those kinds$_{V-S}$ DET$_{rel}$ 1sg.agt$_{infix}$-tell =irr

"I will narrate the kinds of stories that they told long ago." [Speaker DBW06:N]

In terms of its association with the segmental material, the LH phrase accent displays multiple linking even more clearly than the !H or the L phrase accents. Perhaps due to its complex structure, the two parts of the LH phrase accent appear to separate and align with two different syllables in the post-nuclear stretch of the utterance. The L part of the LH phrase accent generally links with the immediate post-tonic syllable of the last pitch-accent, while the H part links to the final syllable of the (intermediate) phrase. The F0 values in-between the two ends can be described in terms of phonetic interpolation since, generally, the contour exhibits an almost linear rise from the initial L target to the final H target of the phrase accent.

[11] I have not glossed the word *wóoglakapi* in detail. It is a nominalized construction, derived from a verb. See, for example, Ullrich (2008) for details.

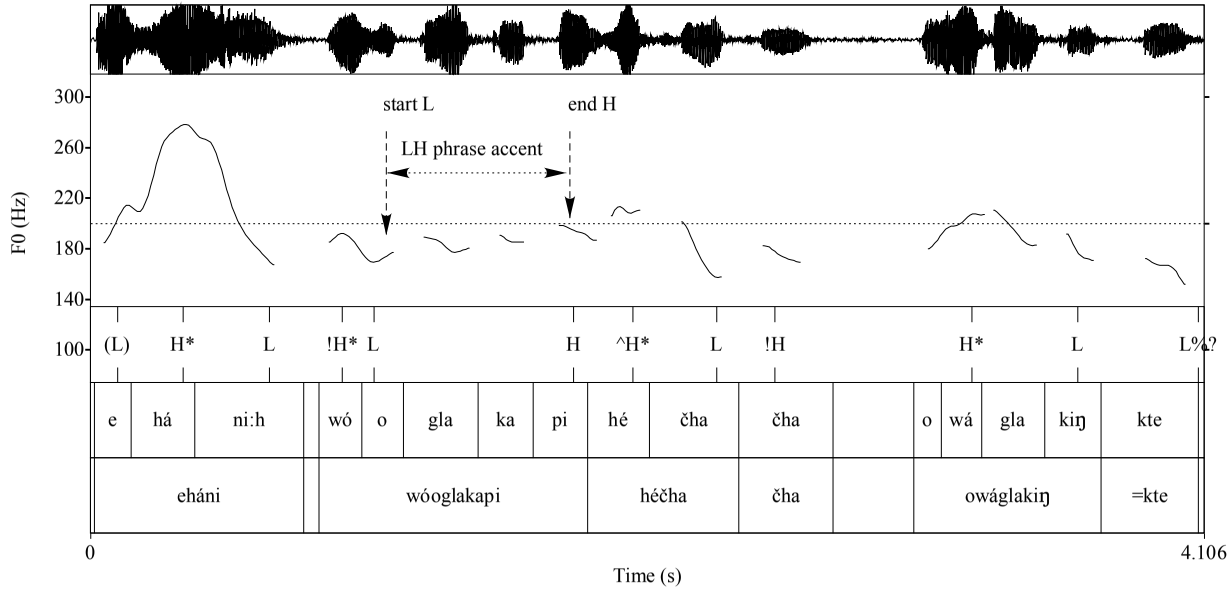


Figure 3.29: The rising LH phrase accent inside the relative clause in example (33). Note that the rise starts at the trailing L tone of the pitch accent, on the syllable [*wó*], and ends with a link to the onset of the next H*L pitch accent on *héča*.

The alignment and near-linear, rising, interpolation features of the LH phrase accent are clearly observable in the portion of the F0 contour in figure 3.29 that is labeled as a "LH phrase accent".

The LH phrase accent appears to have a limited distribution in the data. It occurs mainly inside complex sentences from the narratives - such as the phrase in example (33) - where adjacent pitch accents are separated by several syllables. One could posit LH phrase accents between adjacent {H*L .. H*L} pitch accents in certain shorter phrasal contexts. If so, then the LH phrase accent would appear to occur more frequently. However, when there is not enough phonetic material in between the two neighboring pitch accents the analysis of the associated tonal contour in terms of an LH phrase accent becomes problematic. For one thing, a short stretch of F0 between two neighboring pitch accents can sometimes be described simply in terms of phonetic interpolation. Furthermore, in short stretch contexts where positing a phrase accent seems plausible, it is usually simpler to describe the tone in terms of a !H phrase accent. In the current study I generally take a conservative approach. That is to say, I assign an LH phrase accent only when there is clear evidence for the phonetic realization of both an initial L and a final H along the phrase accent portion of the contour. This usually happens when the textual tier contains enough (usually three or more) syllables linked with the temporal extent of the phrase accent. Future studies of Lakota phrase accents may require a modification of the analysis.

Before leaving the discussion of declarative phrase accents I should clarify that my comments in this section regarding the alignment of phrase accents are preliminary and based on impressionistic observations only. A comprehensive study of the phonetic alignment of phrase accents requires careful examination of the timing of these tonal events in different contexts. In the current analysis I have not carried out such a detailed experimental phonetic analysis. Furthermore, the natural narrative and conversational data that I have collected here are not easily amenable to such an analysis. Despite this particular shortcoming, I have shown that it is possible to observe some interesting regularities in the association properties of the phrase accents depicted in the F0 contours. I return again to the association and alignment properties of phrase accents when I discuss the intermediate phrase in Lakota prosodic structure in Chapter 4.

3.3.5 Summary and Discussion of Lakota Declarative Tunes

In this section I have provided an analysis of pitch accents and edge tones in Lakota declarative utterances. I have identified a basic LH*L maximal core pattern for the pitch accents. This core can be realized in four ways: LH*L, H*L, LH*, or H*. The basic unit H* forms the nucleus of the pitch accent. I showed that in most cases the H* pitch accent nucleus occurs as an F0 peak that is aligned within the temporal bounds of lexically stressed syllables. The declarative data contains more H* and H*L pitch accents than LH* or LH*L pitch accents. However, since the interpretation of the leading L tone in LH* is problematic, it is not easy to quantify how frequent the LH* sequence is. There are several places in the data that I have transcribed an (L) tone in the leading part of an H* or H*L pitch accent.

The data clip in example (34), displayed in figure 3.30, highlights some of the issues with the leading and trailing L tones in the pitch accent analysis. The clip shown is the last portion of a rather long intonational phrase. The first word in this clip, *henáˊ*, carries a long L phrase accent that is terminating the previous intermediate phrase. At the end of this word the pitch drops to a slightly lower target. This point is the start of the stressed syllable of the next word, *hélˊ*, a demonstrative locative adverb that is carrying an H* peak. In cases like these one could make an argument for either an LH* or an LH*L pitch accent on *hél*. Example (34) also highlights a situation were the the interpretation of a trailing L tone may be problematic. In the pitch track in figure 3.30, it is not clear if the L between the two major H* peaks is the trailing L tone of the first word, *hélˊ*, or the leading tone of the second word, *hiyúpi*. It is also possible that there are two L tones between the word peaks; an H*L on the first word and an LH* on the second word. More data and more analysis is needed in order to decide between the various possibilities.

(34) hená , hél hiyú-pi naháŋ

they there arrive-pl and so$_{CONJ}$

"... them, they came down there, and so." [Speaker PRS73:N]

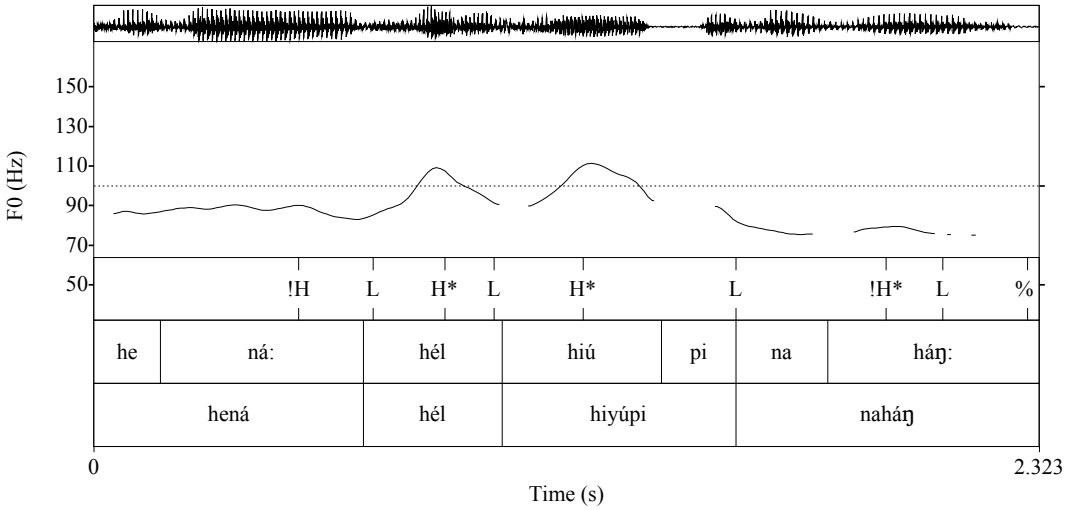


Figure 3.30: Phrase medial pitch accent with possible leading L target; example (34).

In addition to the LH*L maximal pitch accent, the Lakota declarative utterances with narrow and contrastive focus exhibit evidence for an H*HL pitch pattern on the focused item. However, since the corpus for focus type elicitation was limited in speaker and contexts, the analysis of the H*HL as a pitch accent remains inconclusive. I pointed out several of the complications for the analysis of this pitch accent. There is a considerable amount of phonetic work that needs to be done with respect to late peaks, broad peaks, and focus structures. This is left for a future study.

In the current analysis I have identified three types of intonational phrase boundary tones in Lakota declaratives. These are L%, %, and !H%. The low L% is the most frequent declarative boundary tone

and is the one that generally occurs with the glottal stop marking of the declarative mode. The unspecified boundary tone is characterized by a lack of significant pitch movements over the last syllable of the utterance. The !H% boundary is, by contrast, characterized by a slight rise from a low level trailing (or phrase accent) tone at the ends of intonational phrases. The !H% is not frequently used as a declarative boundary tone. In addition to the boundary tones, Lakota declarative utterances also contain phrase accent edge tones which occur either before the boundary tone or in the middle of an intonational phrase. The analysis has revealed three types of phrase accents: L, !H, and LH. The L and !H phrase accents are the most frequent ones in declaratives. The LH phrase accent usually occurs phrase medially and is characterized by a steady stretch of rising pitch that establishes a new high level inside the intonational phrase.

3.4 Large Scale Tonal Patterns in Lakota Declaratives

An interesting feature of Lakota intonational phrases to explore is the scaling relationship between the heights of subsequent F0 peaks. The unfolding of the F0 track inside declarative intonational phrases, in various languages, shows a general downward trend as the utterance progresses (Pierrehumbert & Beckman 1988).[12] Studies of intonation and prosody agree that there can be different sources for F0 downtrend. Observations from the Lakota declarative data here indicate that there are at least three distinct contributions to the subsequent lowering of pitch across the duration of an intonational phrase. These three sources are downstep, declination, and final lowering. In this section I summarize some of the characteristics of these three sources of F0 lowering and show how they effect the large scale tonal pattern of Lakota utterances.

[12] The lowering of pitch in declaratives is not a cross-linguistic invariant. Declarative utterances in some languages show constant or rising (upstep) pitch peaks. See Gordon (2005), for example, for a discussion of the rising tone in Chickasaw declarative phrases.

3.4.1 Downstep and Pitch-Span Compression

3.4.1.1 Application of Downstep In Declaratives

The first, and most important, contribution to F0 drop in the intonational phrases in Lakota is the application of downstep at specific points. Phonetically, downstep lowers subsequent H* peaks inside phrasal units, establishing a new high level for the remaining part of the utterance at each point of application. In this manner, downstep causes the tonal space to contract in a cascading staircase as the utterance progresses. This process is illustrated schematically in figure 3.31. The vertical double-arrow lines designate the local tonal space that the speaker uses at given points in an utterance.

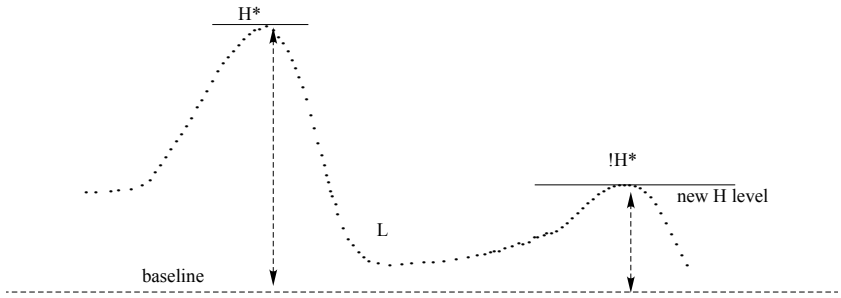


Figure 3.31: Schematic representation of two H* pitch accents, with second accent downstepped relative to first. The tonal space, defined as the amount of pitch range used above a baseline unit, contracts with the application of downstep.

Exmaple (35) illustrates a declarative phrase from the data which contains two clear applications of downstep. The pitch track, shown in figure 3.32, displays the prototypical staircase pattern associated with iterative downsteps. Also noticeable is the successive tonal space compression, followed by a final drop to a low L% boundary tone.[13]

[13] Although I do not discuss boundary strengths here, it is important to point out a fast speech co-articulation phenomenon in the utterance in example (35). Comparing the word tier and syllable tier transcriptions in figure 3.32, it is noticeable that the "expected" word boundary between the particle *ektá* and the verb form *uŋthípi* has been partially erased in fast speech. In LaToBI transcriptions, such word-boundary elision phenomena are coded with break index values, as indicated earlier in section 2.5.3.3 of Chapter 2. I discuss my analysis of Lakota word boundary strengths in detail in sections 4.2 and 4.3 of Chapter 4.

(35) obláye =waŋ ektá uŋ-thí-pi

flat.land $\text{DET}_{indef.real}$ at_{PP} 1.nsg-live-pl

"We lived at a level place on the prairie." [Speaker SOF73:N]

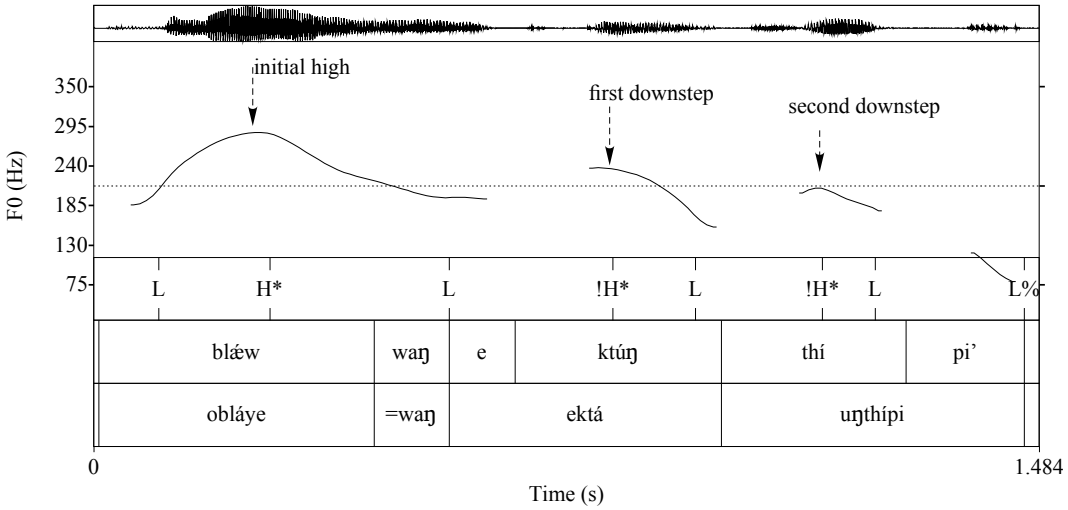


Figure 3.32: Successive application of downstep in a declarative utterance; example (35).

Downstep is very frequent in Lakota declaratives. It can be observed in many of the F0 plots and tonal annotations shown earlier in section 3.3.3. For example, figure 3.13 in section 3.3.3.3 shows a five word Lakota intonational phrase with several downsteps. I have repeated example (16) below with the H* tonal markings. Each successive H* peak after the first word establishes a new level of peak.

(36) H* !H* !H* !H* (!H*)$_{compressed\ pitch}$ L%

čhaŋté waštéya iyúha naŋpé čhiyúzapi

heart good-advz everyone$_{QUANT}$ hand 1.agt.2.pat-take hold of-pl

"With good heart I shake hands with everyone of you." [Speaker DBW06:N]

Table 3.3 tabulates the rate of occurrence of downstep in the Lakota declarative corpus, according to task and speaker. All speakers use downstep, with varying rates. Combined together, about 40 to 45% of non-initial H* peaks show downstep. At this point in my analysis, the specific (functional) triggers for downstep in Lakota are not entirely clear. It appears from the data that downstep *inside a single intermediate phrase* is at least partly automatic. The presence of intermediate phrase boundaries generally suspends the successive application of downstep. In discuss this matter in more detail in Chapter 4, section 4.4.2, in my analysis of the prosodic structure of Lakota utterances.

Narrative Data	Number of non-Initial H*s	Number of !H* Peaks	% of H* with !
DBW06	83	36	43.4%
DBW09	72	26	36.1%
SOF73	53	28	52.8%
PRS73	45	13	28.9%
Total:	*253*	*103*	***40.6%***
Elicited and Scripted Data			
DBW09E	14	7	50.0%
DBW09S	44	19	43.2%
DBW09SC	21	10	47.6%
Total:	*79*	*36*	***45.6%***

Table 3.3: Rate of downstep in non-IP-initial peaks, organized according to task and speaker.

3.4.1.2 Pitch Span Compression

Another distinguishing feature of tonal scaling that is sometimes observed in Lakota declaratives is tonal space compression. These pitch span compressions take place in two distinct ways.

One way in which the pitch span gets extremely compressed is through several successive applications of downstep. Referring back to example 36 discussed earlier in subsection 3.4.1, recall that after the fourth word, *naŋpé*, the tonal space in the utterance has contracted about as much as it possibly can. The pitch span on the last word in that utterance is so narrow that it is difficult to distinguish a clear pitch peak on the verb *čhiyúzapi*. This kind of a pitch span compression is automatic and takes place simply as a result of several downsteps applied to a finite tonal space.

The second way in which the tonal space contracts is much more drastic and sudden. An example of such a sudden compression was displayed earlier in figure 3.22, in section 3.3.3.9, in the context of de-accenting. Phrase final compression is rather frequent. However, the sudden pitch span compression is not limited to IP-final position, nor is its domain limited to single words. Figure 3.33 displays a case of IP-medial pitch span compression which takes place in the first clause of a complex sentence, shown in example (37).

(37)	táku	=waŋ	naȟ'úŋ-pi	ča	áta	iyúha	inážiŋ-pi	=kéye='
	something	=DET$_{indef.real}$	hear-pl	DET$_{rel}$	entirely	all$_{QUANT}$	cease-pl	=quot=decl

"They heard something and, really they all stopped, it's said." [Speaker DBW06:N]

Utterance medial pitch span compressions often occur in complex constructions involving dependent or nominalized clauses. These compressed pitch spans can continue over an entire embedded clause. There is probably a relationship between these compressed pitch ranges and phrase accents discussed in section 3.3.4.2. The L or !H phrase accents sometimes show a flat pitch over a long portion of an utterance. The rising LH phrase accent in figure 3.29 also occurs in a rather compressed pitch range compared to the previous H* peak in the sentence. However, my data for this study does not allow me to pursue the relation between pitch span compression and phrase accents at this point. More data and analysis with compressed pitch ranges is needed for future research.

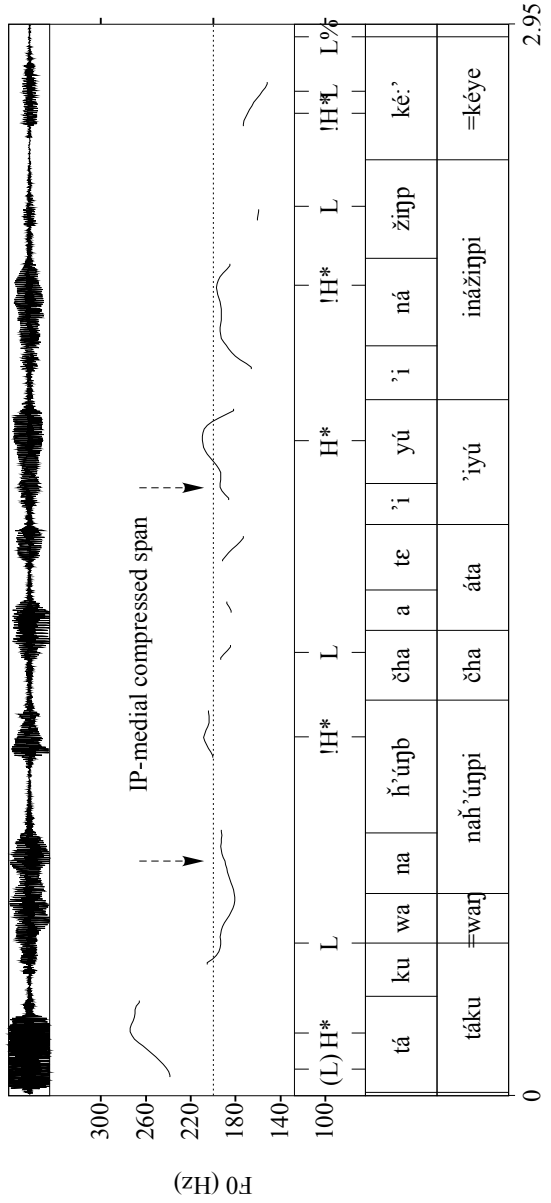


Figure 3.33: IP-medial pitch span compression. Note that the pitch span expands at a lower range, in the second clause.

3.4.2 Declination of F0

A second, less dramatic, source for F0 drop in Lakota declaratives is declination. The term declination in intonation refers to a gradual, downslope, lowering of pitch that unfolds over the course of the intonational phrase. Unlike downstep, declination is usually shallower in slope and does not apply at any specific point. As indicated earlier, F0 declination can be used as a cue to intonational phrase boundaries; declination resets at the end of an intonational phrase. Figure 3.34 shows the pitch track for the intonational phrase in example (38). The dashed line across the pitch track in the figure is a calculated declination curve with a least-squares fit to all the data points in the F0 contour.

(38) ho hehą́ŋl akhé wagmíza kȟó pus-yá-pi na

so then again corn also dry-caus-pl and$_{CONJ}$

"So then, again, they dried the corn as well, and ..." [SOF73:N]

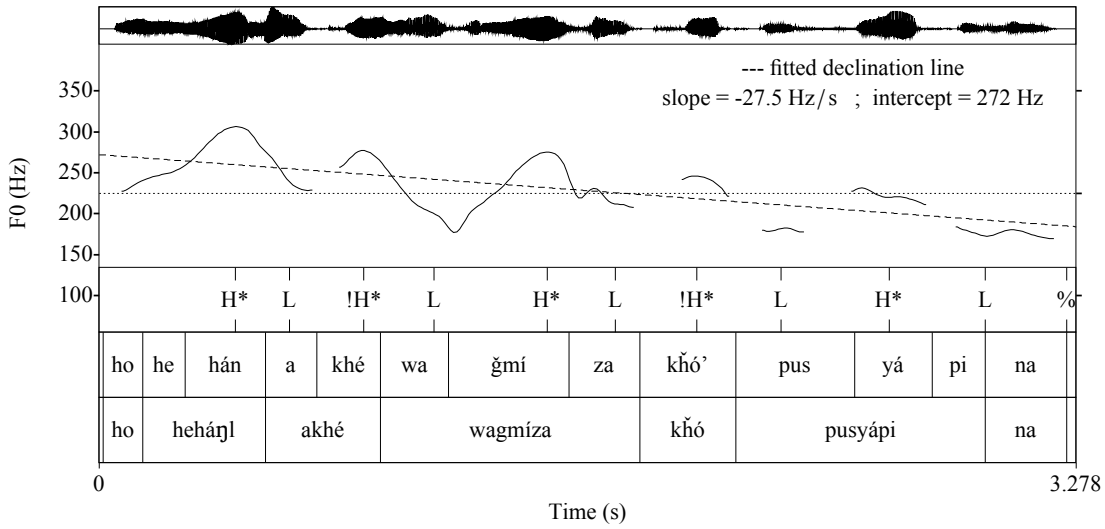


Figure 3.34: Overall F0 downtrend in example (38), with fitted curve indicating the rate of down-drift. The fitted curve is a least-squares line fit to the points on the F0 curve.

Note that overall declination is distinct from downstep. For instance, in the sequence *akhé wagmíza* in example (38), the two H* peaks are not downstepped relative to each other. However, a sense of shallow declination continues across these words. There is no declination reset between the words since a continuous, well formed pitch track continues across. Downstep applies to the following peak on *kȟó*.

Figure 3.35 shows another way of displaying the difference between declination and downstep. This figure consists of a scatter plot of the difference in F0 peak values for adjacent noun-modifier pairs, sampled from the entire declarative database.[14] In oder to create this figure I searched the database for noun+modifier sets in which the modifier was an accent-bearing word, such as a numeral, an adjective/stative verb, or another noun. Some of the noun-modifier sequences show downstep while others do not.[15] In the pairs that do show downstep (plotted with circles in figure 3.35) there is a steeper F0 slope so that the H* of the modifier is lower than the H* of the noun by a larger amount. In addition, for cases with downstep, the F0 difference between noun and modifier is larger at the higher pitch ranges. This can be seen from the wider scattering of the circle shaped plot points in the higher F0 regions.

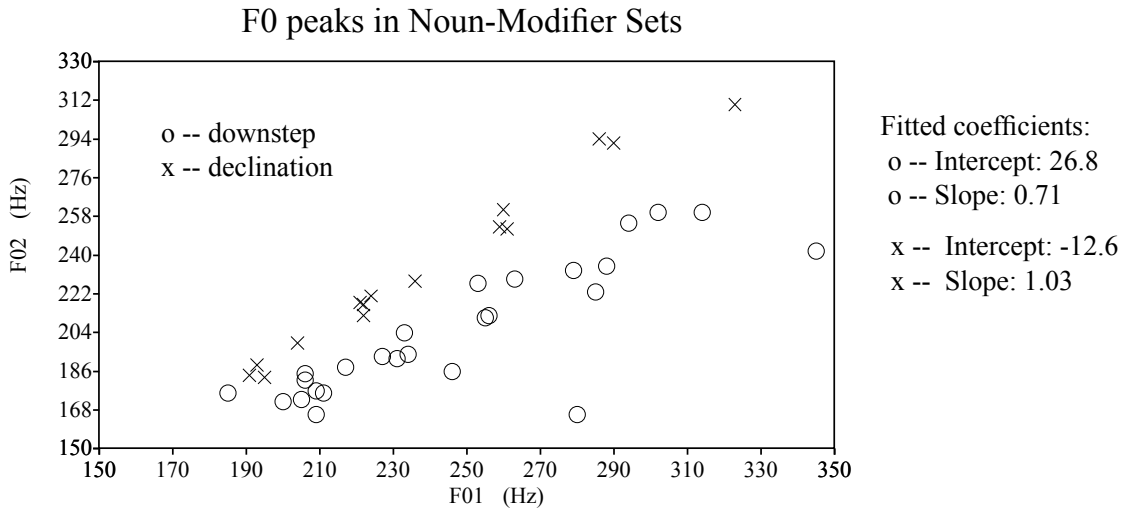


Figure 3.35: F0 of Modifier (F02, vertical) versus F0 of Noun (F01, horizontal) in Lakota Noun+Modifier phrases inside declaratives. The "o" data points are cases where downstep applies. The "x" data points are cases where no downstep applies. The data used for creating this graph consists of phrases form both narratives and scripted conversations. All speakers are represented.

[14] Lakota modifiers are generally placed after the noun. See Ullrich (2008) and Rood & Taylor (1996) for details.

[15] There was no significant correlation here between N-Mod type and the application of downstep. In most cases, as can be seen from the distribution of the number of plot points in figure 3.35, downstep does apply. I discuss this further in Chapter 4.

The signature of declination is not always clear in Lakota utterances. Example (39) and accompanying figure 3.36 show a declarative utterance where downstep applies but down-drift is not very prominent. Past the initial, object NP the declination is very negligible. Also, the last low in the utterance is not significantly lower than the L tone between the middle words *áta* and *iyúha*.

(39) čhaŋkú =ki áta iyúha natȟáka-pi čha

road =DET$_{def}$ entirely all$_{QUANT}$ close-pl so$_{CONJ}$

"They closed all the roads, so ..." [PRS73:N]

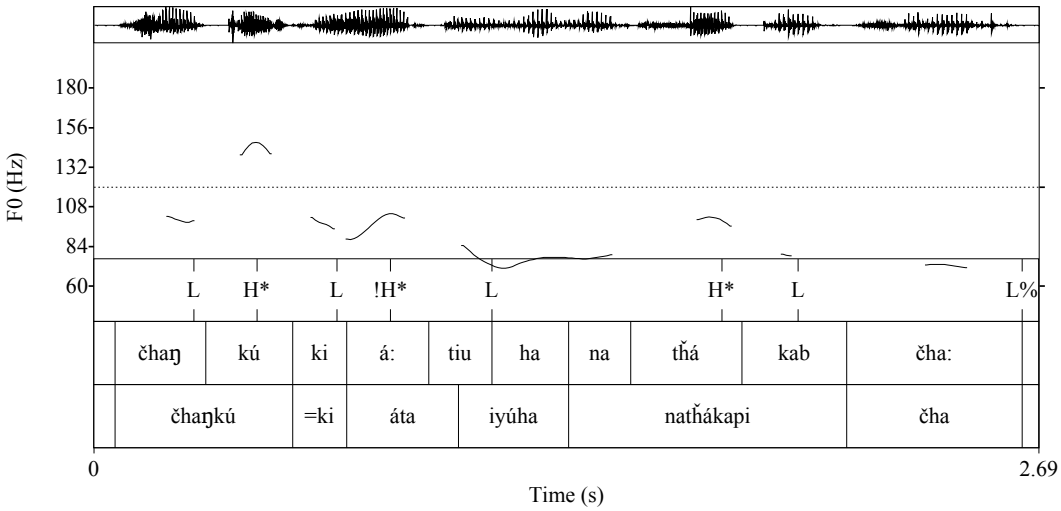


Figure 3.36: Pitch track for example (39), where downstep applies but declination is not very prominent.

3.4.3 Utterance-Final Lowering and Creaky Voice

The third source of downward F0 movement in Lakota declaratives is final lowering. As the name implies, final lowering is a temporally localized event, taking place at the very end of declarative intonational phrases. It applies usually during the very last one or two syllables in the intonational phrase, spanning a duration of about 500 milliseconds or less. Phonetically, final lowering manifests as a sudden sharp drop in

F0 at the right edge of the intonational phrase. Final lowering co-occurs only with the L% boundary tone. However, not all L% boundary tones show a sudden final drop.

Final lowering can be seen in some of the F0 tracks of the declarative utterances already shown. For instance, in figure 3.24 in section 3.3.4.1 the final syllable of the declarative utterance has a sharp drop at the very end. Dramatic final drops can lead to creaky phonation. This can be seen in the pitch track for example (40), shown in figure 3.37. Note the steep fall during the last syllable in the utterance.

(40) ptewániyaŋpi =waŋ waŋbláke

domestic cow $\text{DET}_{indef.real}$ 1.sg.agt.see

"I saw a cow." [DBW09:S]

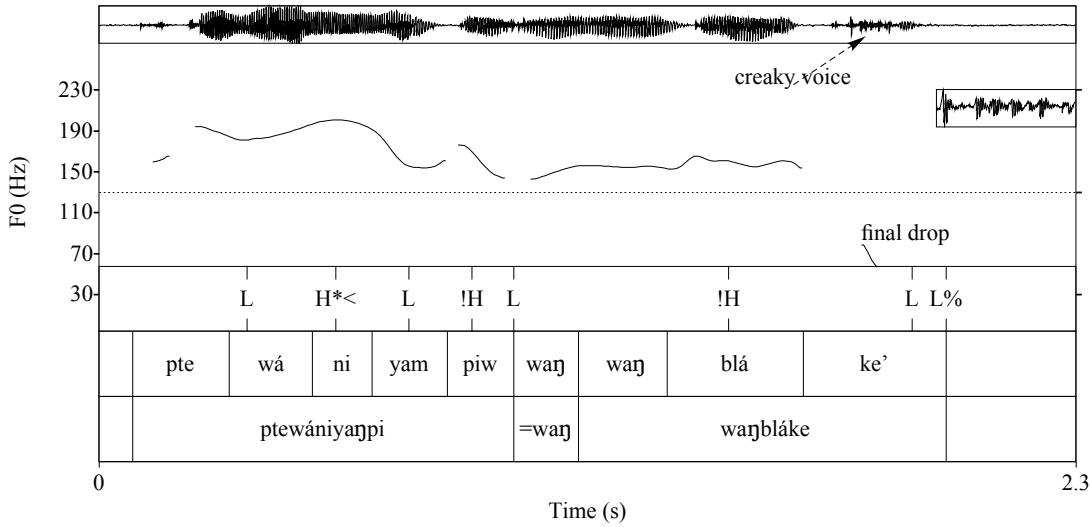


Figure 3.37: Final sharp drop to a low pitch at a declarative boundary, accompanied by creaky phonation. The slope of the final fall is approximately -540 Hz/s, which is steep compared to the general down-drift rate of about -28 Hz/s seen in figure 3.34. The inset on the right side of the figure displays an expanded view of the waveform for the last syllable of the utterance. The jitter in the voice beats corresponds to creaky phonation during the last vowel.

At this point in the analysis it is not clear if the final drop, along with the creaky phonation, is a reflex related to the declarative final glottal stop discussed in section 3.3.1. In example (40), where there is a final drop, I hear a creaky phonation but no final glottal stop. On the other hand, example (41), displayed in figure 3.38, is a case where I hear a glottal stop at the end of the final drop. The final glottal stop in example (41) is, however, somewhat subtle. It does not seem to leave a significant mark in the spectrum at the end of the utterance (displayed in the side-panel in figure 3.38). The systematicity of final glottal stops in Lakota, along with their relation to final falls, needs to be researched more carefully in a future study.

(41) iȟát'a-t'a áta wógla-gla-ka nážiŋ-pi =ké='

laughing$_{REDUP}$ entirely talking$_{REDUP}$ stand-pl =quot=decl

"They were standing around really talking and laughing, it's said." [DBW06:N]

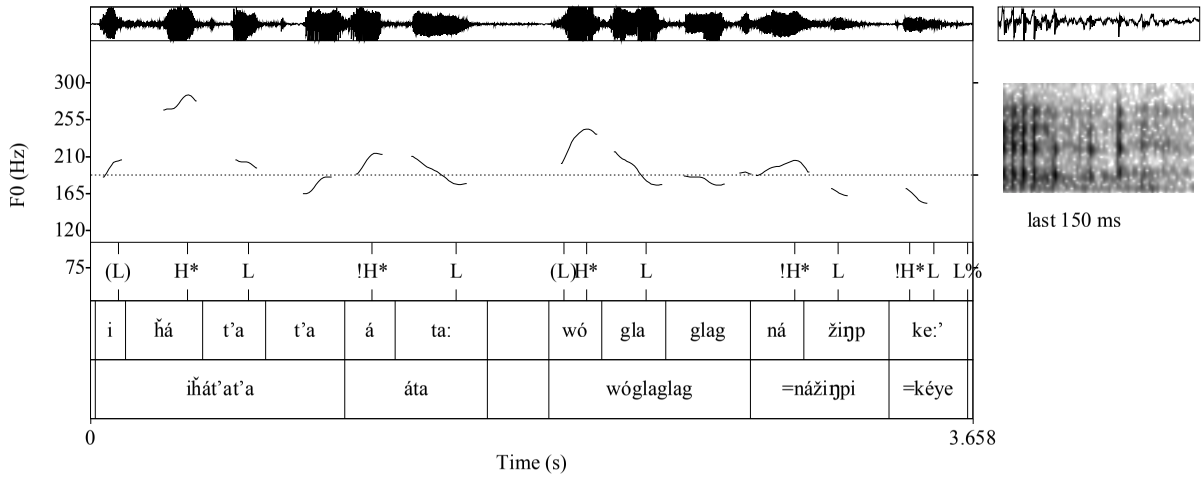


Figure 3.38: Final drop along with an audible final glottal stop in a quotative declarative utterance. The right hand panel shows the waveform and the spectrogram for the last 150 milli-seconds of the utterance where the glottal stop happens.

3.5 Intonation in Lakota Interrogative Utterances

3.5.1 Interrogatives in Lakota - A Review

The interrogative as a type of utterance in Lakota is discussed briefly in Boas & Deloria (1941). In the introduction section of their grammar, Boas & Deloria note that the interrogative is a modality expressed by the use of sentence final enclitics. The section on interrogatives (Boas & Deloria 1941:111) points out several enclitics that mark a sentence as a question. The enclitics cited are listed in table 3.4.

	Lakota Question Enclitic	Function
	he	used by men and women in formal speech
	so	used by men and women in conversation
	huwó	used by men
	huwé	used by women

Table 3.4: Interrogative Enclitics in Lakota described by Boas and Deloria.

Rood & Taylor (1996:474) state that several enclitics, in position 12 in their enclitic table (see table 4.1 on page 152), are used to mark various types of questions. They state that the enclitic *he* is used to mark direct questions by both men and women, but that men use *huŋwó* in some formal situations. They also state that the enclitic *so* is used for marking questions in which there is no presupposition that the addressee knows the answer. The short description of question enclitics in Ullrich (2008:764) is more-or-less the same as what is given in Boas & Deloria (1941) and Rood & Taylor (1996). These various interrogative enclitics can be used to mark both yes-no and pronominal questions. Examples (42) and (43) illustrate the use of the enclitic *he* for marking each of these types of questions.

(42) yes-no question: *wóyute nič'úpi he*

wóyute ni-k'ú-pi =he

food 2.pat-give-pl =interr

"Did they give you food?" [Speaker DBW09:S]

(43) pronominal question: *táku nič'úpi he*

táku ni-k'ú-pi =he

what 2.pat-give-pl =interr

"What did they give you?" [Speaker DBW09:S]

The interrogative pronouns used in the pronominal questions all start with the phoneme /t/. These interrogative pronouns are part of a class of "T-words" in Lakota. The T-words by themselves can function as indefinite pronouns or stative verbs. When they occur in a question sentence, marked by one of the interrogative enclitics, they are interpreted as pronominal question words.[16] The predominant word order in interrogatives, as in other modalities, is verb-final. It is important to also note that the interrogative pronouns in Lakota do not always occur in clause-initial position. For instance, the interrogative pronoun *táku*, "what", can be preceded by a subject NP (if this is lexically expressed), a demonstrative, or an adverb. Example (44) shows a pronominal question sentence with a subject NP in initial position, followed by the interrogative pronoun *táku*.

(44) *wakȟáŋheža ki hená táku ečhúŋpi he*

wakȟáŋheža =ki hená táku ečhúŋ-pi =he

child =DET$_{def}$ those$_{DEM}$ what do-pl =interr

"What are those children doing?" [Speaker DBW09:S]

The main difference between interrogatives and declaratives cited in the previous literature on Lakota is that the two modalities are marked by different sentence final enclitics. The simple declaratives generally have the final glottal stop while the interrogatives have one of the question marking enclitics. As far as intonation is concerned, the general, unstated, impressionistic consensus is that Lakota interrogatives (both yes-no and pronominal) end in a low or falling contour, as in declaratives.

[16] For a more complete discussion of Lakota T-words refer to Ullrich (2008:761).

In what follows I consider in detail some of the characteristics of the F0 contour in Lakota interrogative utterances. I compare the findings to the patterns of intonation in declarative utterances described in sections 3.3.3 and 3.3.4. The particle *he* is the only interrogative enclitic that was used in the data collected for this study. Therefore, in the following description of the intonation of Lakota interrogatives, I examine pronominal and yes-no questions ending with the enclitic *he* only. Possible intonational differences between the various types of questions described in table 3.4 would be the subject of another study.

3.5.2 The Interrogative Data Subset

The set of utterances used for the analysis of Lakota yes-no and pronominal questions is based on a subset of the data described in 2.3.1. The majority of the sentences for the interrogative database are from the scripted conversations with speaker DBW. In addition, a portion of the interrogative database is based on direct elicitations for different focus structures, from speaker DBW. Since the stories and autobiographical narratives are all monologue speech, they do not contain many interrogatives. One of the narratives (DBW09) has a single token of a yes-no question in quoted speech. I only briefly remark on this in the discussion section since a full analysis of quoted speech and intonational tags is beyond the scope of this chapter. As in the declarative database, I employed several criteria for choosing the utterances to be included in the analysis. Only question phrases that have a clear F0 contour with measurable properties are included. Furthermore, I tried to incorporate question phrases with different lengths and different focus structures.

After applying the selective criteria to the raw data, the interrogative subset analyzed contains a total of 25 intonational phrases, representing both pronominal and yes-no questions. The interrogative corpus subset was extracted from the list of sentences displayed in tables A.5, A.6, and A.7 of Appendix A. The interrogative phrases in these tables are labeled with the abbreviation "interr." in the utterance-type column. As already stated, all the interrogative phrases analyzed here are of the type that are marked with the question enclitic *he*. The interrogative focus types include narrow focus (NF) on object, subject, and verb. There is also a small sample of elicited predicate focus or broad focus (BF) questions. The distribution

of question types analyzed is shown in table 3.5. In this table I have categorized the pronominal questions into *táku* ("what") questions and *tuwé* ("who") questions. Furthermore, I have subcategorized each of these into the type of focus that is implied in the conversational exchange. Most of the pronominal questions involve narrow focus contexts. The focus in the yes-no questions is difficult to assess without further context. I have marked these according to whether they received a negative or a positive response in the scripted conversation. The negative responses to the yes-no questions usually involve a contrastive focus statement, with the contrastive NP in the response marked with a special article.

	Pronominal: =*he*			Yes-No: =*he*		
	táku: NF	táku: BF	tuwá: NF	-response (CF)	+response	*Total*
DBW09:S	5		1	5	3	*14*
DBW09:SC	1		1		1	*3*
DBW09:E	1	2	2	1	2	*8*
Total:	*7*	*2*	*4*	*6*	*6*	**25**

Table 3.5: Number and types of Lakota questions analyzed. The distribution of interrogatives is organized according to question categories (pronominal or yes-no) and focus/response types. The abbreviations are: NF=narrow focus, BF=broad focus, CF=contrastive focus. All the sentences are from speaker DBW.

As in the description of declarative intonation, the analysis I provide here is based on observations and measurements of major tonal peaks inside phrases and tonal movements or stabilities at the edges of phrases. Pitch peaks are labeled for all major category Lakota words in the utterance that carry an accent. In addition, I carefully analyze the tonal movements in the vicinity of the question enclitic *he* and in clause-initial position. In the case of pronominal questions I analyze the tonal characteristics in the vicinity of the T-words as well.

3.5.3 Tunes of Yes-No Questions in Lakota

3.5.3.1 IP-Final Characteristics of Yes-No Questions

The interrogative data generally supports the previous impressionistic observations that question tunes in Lakota have a falling contour. The F0 starts high in the beginning parts of the utterance and, via slow

declination and the application of a series of downsteps, ends in the lower part of the speaker's range. In this respect, the yes-no questions show no overall tonal differences from the declarative utterances. The core LH*L pitch accent, along with the various allo-tones, are used in yes-no questions as well. Figure 3.39 shows the pitch track of the yes-no question in example (45). Note that the pitch accents on the subject, the demonstrative, and the verb are variations of the maximal core LH*L.

(45) Lakȟóta =ki lená wačhí-pi =he

Lakota =DET$_{def}$ these$_{DEM}$ dance-pl =interr

"Are these Lakota people dancing?" [Speaker DBW09:E]

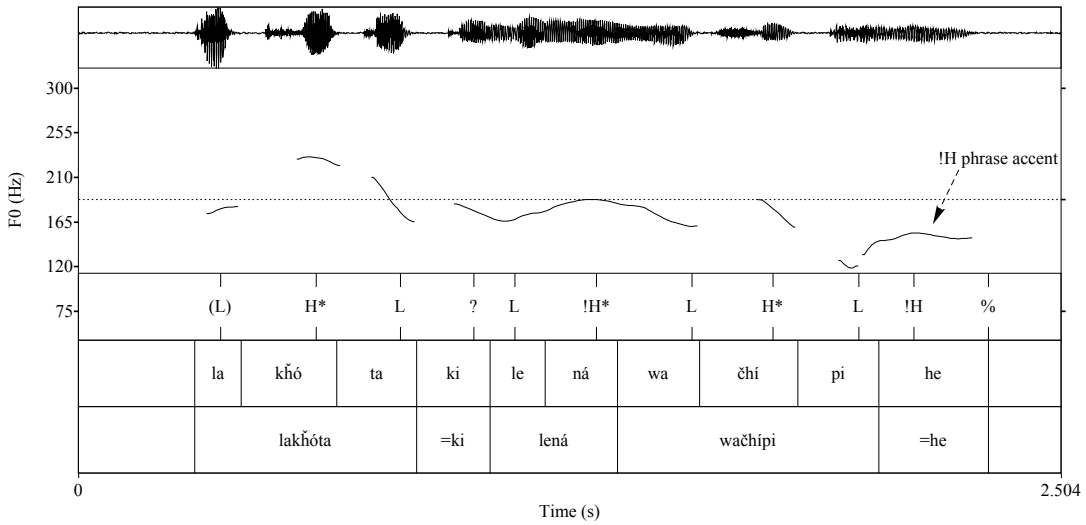


Figure 3.39: Tune of Lakota yes-no question in example (45), with H* and !H* peaks. The final enclitic *he* carries a !H phrase accent.

There are some interesting IP-final patterns in question tunes that have not been noted before in the literature. In particular, the enclitic *he* carries a low pitch-range peak or plateau before the end of the utterance is reached. This is very clearly visible in figure 3.39. According to the grammars and dictionaries, the question enclitic *he* is not a lexically stressed item. My own impressionistic observations are in agreement

with this claim. Therefore, following the tone labeling conventions outlined in section 2.5, any F0 peak within the temporal bounds of the *he* enclitic is not labeled with a * diacritic (i.e., it is not a pitch accent). Enclitic *he* thus carries an IP-final !H edge tone. The intonational pattern at the end of the yes-no question in example (45) consists of a !H phrase accent followed by % (flat) boundary tone.

The flat % boundary is the most frequent boundary tone in the yes-no questions. However, there are some questions that exhibit a final L%, dropping, boundary after the !H phrase accent on *he*. The L% boundary occurs in the token of yes-no question shown in example (46).

(46) David hayápi otúȟ'aŋ =he

David clothes donate =interr

"Did David donate clothes?" [Speaker DBW09:S]

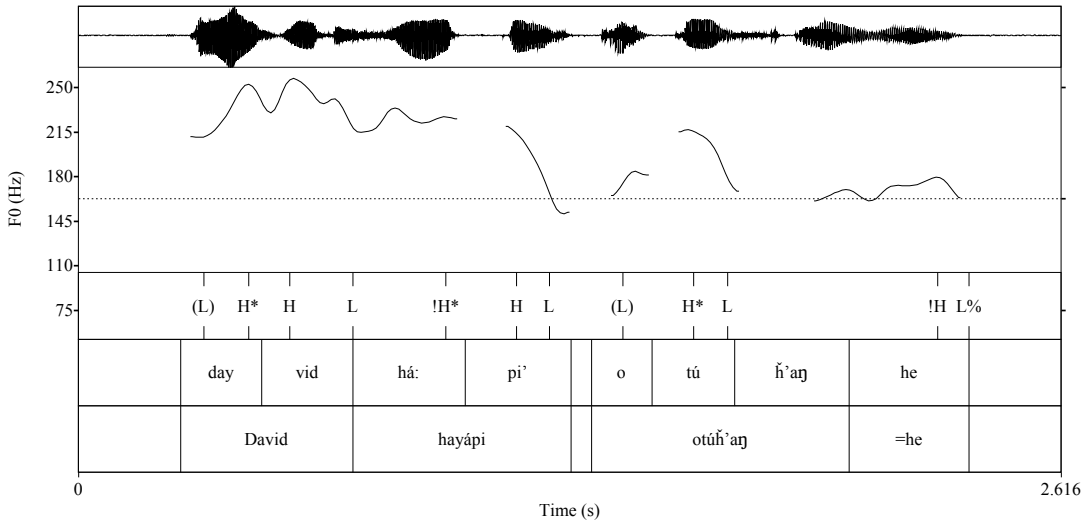


Figure 3.40: Final L% boundary tone in the yes-no question in example (46). Note again the !H phrase accent on the interrogative enclitic *he*.

The pitch contour for example (46) displays several interesting pitch accent and pitch level features across the nominal phrases at the start of the intonational phrase. I now turn to the discussion of these IP-initial tonal patterns in yes-no questions.

3.5.3.2 IP-Initial Characteristics of Yes-No Questions

One important observation regarding yes-no questions is that they tend to have an initial high pitch level that spans over the first major category words of the utterance. Given the prototypical SOV order of questions, the initial high pitch level typically spans the subject and/or the object NP. The high pitch level also extends over initial adverbs, if these are present. In example (46), both the subject NP *David*, and the object NP, *hayápi* ("clothes") are at a high pitch level, in a rather compressed pitch range. The phrase exhibits a sudden pitch span expansion that applies at the syllable [.pi.], at the end of the object NP.

In addition to the raised pitch level, the NPs at the beginning of yes-no questions frequently carry the H*HL pitch accent pattern, discussed in section 3.3.3.6 in the context of narrow focus in declaratives. The H*HL pattern can be seen on both the subject and the object NPs in figure 3.40. The question in example (46) was elicited with intended focus on the object NP, *hayápi*. The response to the question in (46), in the context of the scripted conversation, is shown in example (47). Note that the object NP in the response, *mázaská* ("money"), is marked with the article *čha* for contrastive focus.[17]

(47) hiyá , David mázaská čha otúȟ'aŋ

No. David money DET_{rel} donate

"No. It was money that David donated." [Speaker DBW09:S]

[17] The response statement shown in example (47) was produced with pauses and re-starts. The intonational contour was too difficult to analyze, and was not included in the declarative data subset. I have displayed the phrase here merely as a way of showing that the pragmatic implication in the context of the question was one of contrastive focus on object.

Another distinctive intonational feature of the yes-no question tunes in the data is that they show late peak alignment much more frequently than the declarative utterances. Recall from section 3.3.3.5 that late peaks are not very frequent in the declarative phrases from the narrative genre. The scripted conversation tasks showed the highest rate of late peaks in declaratives, with 11.5% of all peaks being late in these tasks (see table 3.1). Also recall that the delayed peak in declaratives occurs usually in IP-initial position. Late peak alignment is much more frequent in questions, especially in contexts with intended narrow and contrastive focus. Of the 12 yes-no question intonational phrases analyzed, 4 show delayed peaks on the the phrase-initial noun. Example (48) is a yes-no question token that shows an IP-initial late peak on the object NP, *wóyute*, "food".[18]

(48) *wóyute* *nič'úpi* *he*

wóyute ni-k'ú-pi =he

food 2.pat-give-pl =interr

"Did they give you food?" [Speaker DBW09:S]

The observations concerning the H*HL pitch accent and late peak alignments suggest that Lakota yes-no questions exhibit phrase-initial intonational features that are rather similar to the declarative utterances with narrow focus. The frequent occurrence of the H*HL pitch accent and delayed peak in IP-initial position are exactly what is observed in several of the narrow focus declaratives discussed in sections 3.3.3.5 and 3.3.3.6.

[18] The !H pitch following the delayed H* in figure 3.41 could either be the second part of an H*!H pitch accent or a !H phrase accent. I am not certain of the analysis of this !H here.

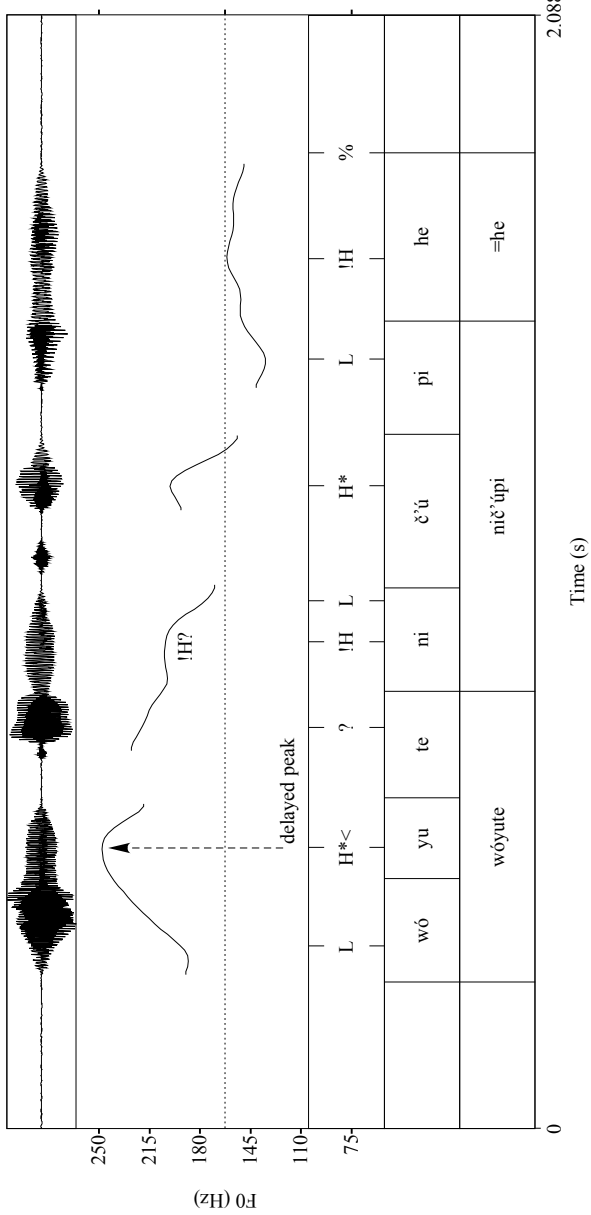


Figure 3.41: Delayed H* peak on the IP-initial object NP, *wóyute*, in the question phrase in example (48).

3.5.4 Tunes of Pronominal Questions in Lakota

The F0 contours of pronominal questions show general features that are very similar to tunes in yes-no questions. I will not re-iterate all these points in this section. The discussion of pronominal questions below focuses on several unique and outstanding tonal characteristics of these question types. In particular, I focus on F0 peak alignments and the types of pitch accents that the pronominal question words carry.

3.5.4.1 Táku Pronominal Questions

Pronominal question types, just like the yes-no question types, start high in the beginning of the utterance and, by slow declination and the application of a series of downsteps, end in the lower part of the speaker's range. The final enclitic *he* at the ends of pronominal question phrases carries a !H phrase accent. The core LH*L pitch accent and its various allo-tones occur in pronominal questions as well. Figure 3.42 shows the pitch track of the pronominal question in example (49). The outstanding tonal feature of this phrase is that the first major peak, on the IP-initial t-word *táku*, is aligned late relative to the stressed syllable.

(49) *táku nič'úpi =he*

táku ni-k'ú-pi =he

what 2.pat-give-pl =interr

"What did they give you?" [Speaker DBW09:S]

The late alignment of the H* peak on *táku* holds for most of the tokens of this question word when it occurs in IP-initial position. Out of the eight pronominal questions that use *táku*, five tokens have the question word in IP-initial position. In four out of these five cases *táku* has a delayed peak, similar to what is seen in figure 3.42. This pattern holds true for the scripted conversation and elicitation tasks. The one token

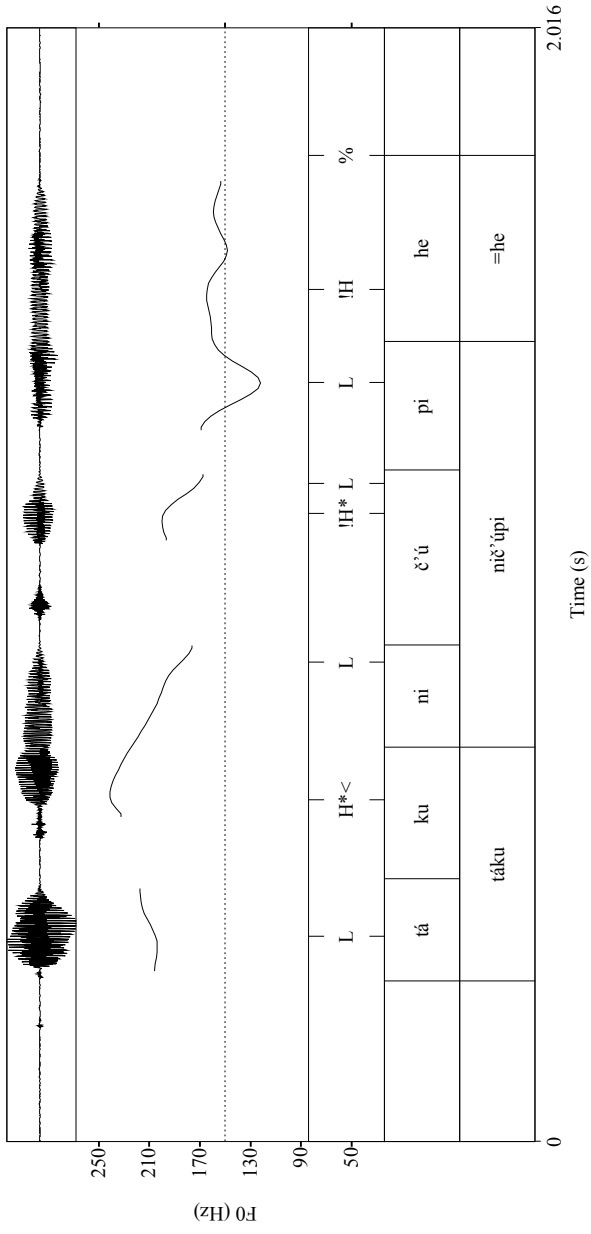


Figure 3.42: Tune of Lakota T-word question in example (49), with H* and !H* peaks. Note the late alignment of the peak on *táku*.

of *táku* that displays on-time alignment in IP-initial position is shown in (50), with pitch track display in figure 3.43. In this phrase *táku* is pronounced in its mono-syllabic fast speech form, *tág*; the final unstressed vowel is dropped and [k] changes to voiced [g]. The only remaining syllable carries the pitch accent.

(50) *tág* *tókȟa* *=he*

táku tókȟa =he

what something is wrong$_{V-S}$ =interr

"What is the matter?" [Speaker DBW09:E and DBW09:S]

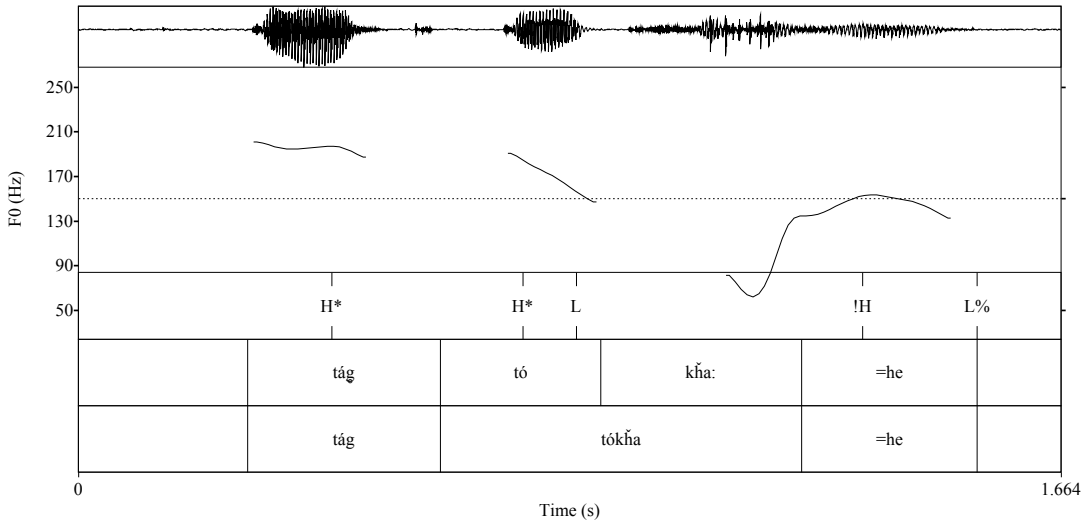


Figure 3.43: Lakota T-word question in example (50), with H* peak showing on-time alignment on *tág*, the reduced form of *táku*.

In terms of focus structure, the T-word question in example (50) is the only token of *táku* in the data that was uttered in a context with potential predicate or sentence focus. Meaning, there is no nominal entity, or set of nominal entities, that are presumed fillers for *táku* in the response to the question. By contrast, the cases of *táku* with late peak alignment are more specific questions, with pragmatically implied narrow focus on the nominal expression.

Recall from section 3.5.3 that NPs at the onset of yes-no question phrases frequently carry an H*HL pitch accent. The pronominal questions with IP initial T-word *táku* clearly do not carry this pitch pattern, as seen in example (49). Instead, more frequently, *táku* initial questions display an LH* pitch accent, with a delayed peak. However, pronominal questions in which *táku* is not in phrase-initial position do carry a pitch pattern that is phonetically similar to the H*HL sequence. Figure 3.44 displays the the pitch track for the question phrase in example (51). In this example, *táku* is in second, object, position, preceded by a lexical mention of the nominal subject. In the pragmatic context of the scripted conversations, the utterance in example (51) was produced with implied narrow focus on the (object) T-word. The pitch track in figure 3.44 shows that the peak of the non-initial (object) *táku* is not delayed and that the unstressed second syllable of the pronominal question word now carries an H tone.

(51) Chuck táku otúȟ'aŋ =he
Chuck what donate =interr
"What did Chuck donate?" [Speaker DBW09:S]

The analysis of an H*HL pitch accent on *táku* in figure 3.44 remains questionable however. The first problem is with the trailing L tone; it may either be slightly undershot or not present at all. The pitch track is interrupted here by the glottal stop onset of the following vowel-initial verb, which causes a sharp dip in the F0 contour. It is also possible that the post-tonic H tone on the second syllable of *táku* in example (51) is the manifestation of a phrase accent. At this point I do not have enough interrogative data with the T-word in object position to decide among the various possibilities.

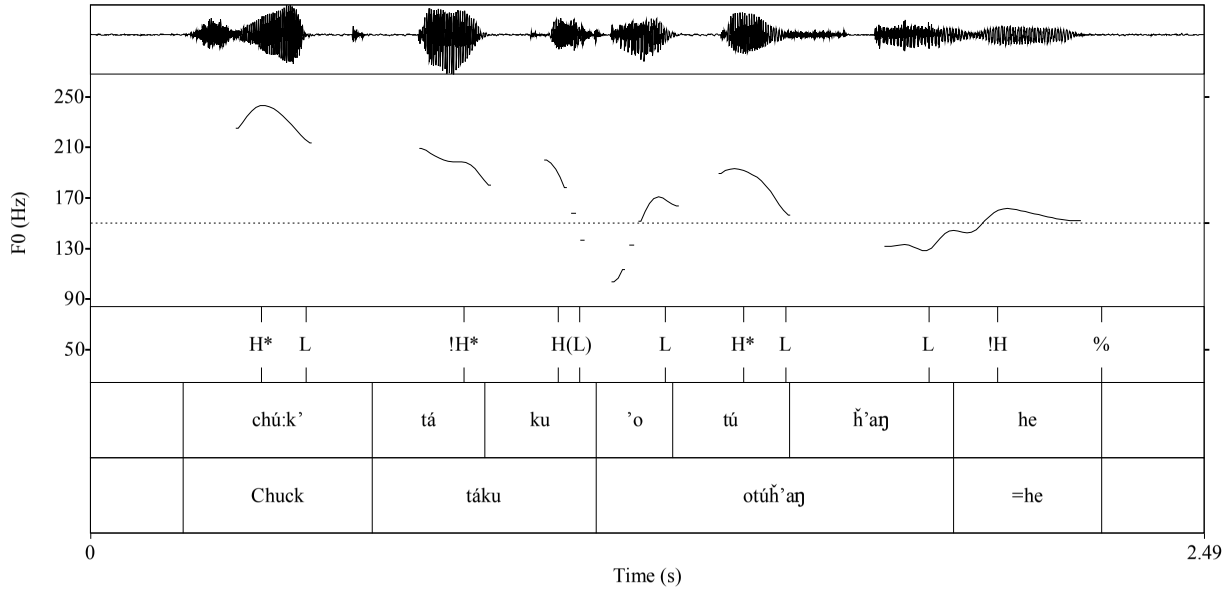


Figure 3.44: Lakota pronominal question tune with T-word *táku* in second (object) position, in example (51). The H* pitch accent nucleus of *táku* occurs on the stressed syllable, followed by an H(L) tone on the second syllable.

3.5.4.2 Tuwá/é Pronominal Questions

The pronominal questions starting with the T-words *tuwá* ("who") and *tuwé* ("to be who?", a stative verb) are slightly different from *táku* in their tonal characteristics. This is partly due to the lexical stress difference between these different T-words. Pronominal question words *tuwá* and *tuwé* have second syllable stress with plain alveolar stop [t] at word onset. Recall from section 3.3.3.8 that words with unstressed $C_{[-voice,-cont]}V$ onset syllables display a phonetic H on that first syllable, showing the surface pattern HH*L. The T-words *tuwá* and *tuwé* both satisfy this segmental onset condition. These words typically display a phonetic H on their first syllable. However, unlike the cases discussed in the declarative data, phrase initial *tuwá* and *tuwé* have a flat, high-level pitch accent HH*, without the trailing L tone. Example (52) shows a question phrase with *tuwé* in IP initial position. *Tuwé* is followed by the relativizer (and focus marking) article *čha*. Notice from the accompanying figure 3.45 that the F0 high on *tuwé* remains high into the article *čha* and drops to an L tone at the onset of the next major category word.

(52) tuwé čha wačhí =he

who_{V-S} DET_{rel} dance =interr

"Who is it that's dancing?" [Speaker DBW09:S]

The interrogative dataset also contains phrases with the T-word *tuwá*. When this T-word is in IP-initial position, the tonal pattern is mostly identical to what is seen in figure 3.45 for *tuwé*. The scripted conversations contain an interesting example of *tuwá* in IP-medial position, shown in (53). The intonational phrase in this example contains two clauses. The first clause is a derived locative adverbial. The T-word *tuwá* starts off the second, main, clause. The pitch track of the utterance is shown in figure 3.46. Note the HH* sequence on *tuwá* in IP-medial position.

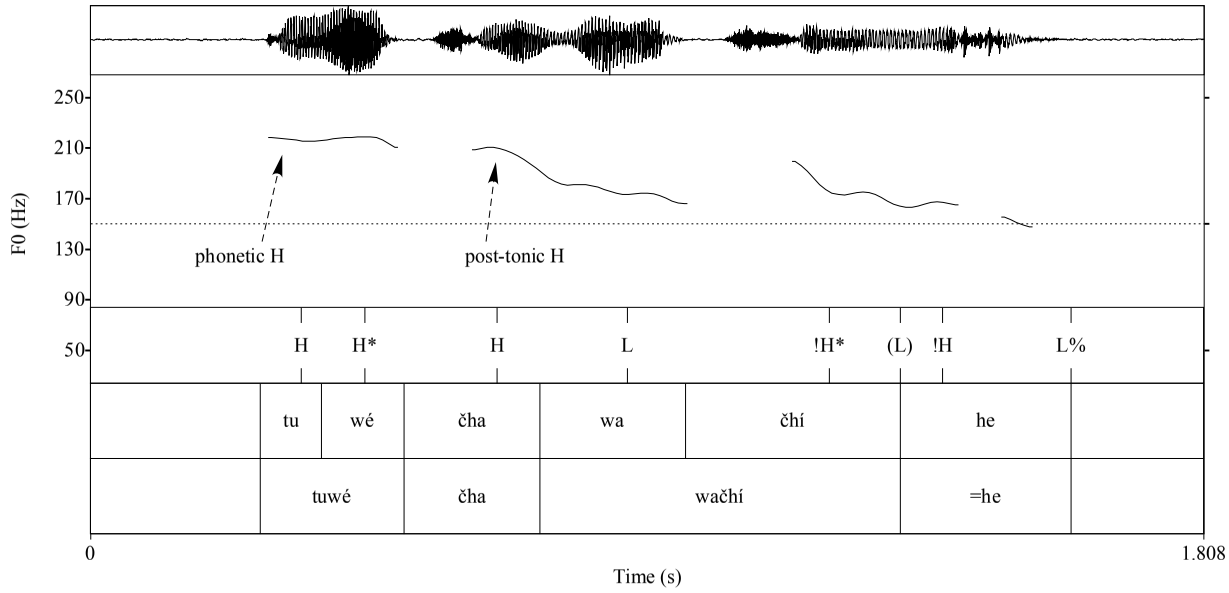


Figure 3.45: Lakota pronominal question tune with T-word *tuwé* in IP-initial position, in example (52). The F0 high associated with the HH* pitch accent on *tuwé* remains high into the item, the article *ča*.

(53) ȟtálehaŋ wačhí-pi ektá tuwá wačhí =he

yesterday$_{ADV}$ dance-pl$_{nomz}$ at$_{PP}$ who$_{PRN}$ dance =interr

"Yesterday at the dance (gathering), who danced?" [Speaker DBW09:SC]

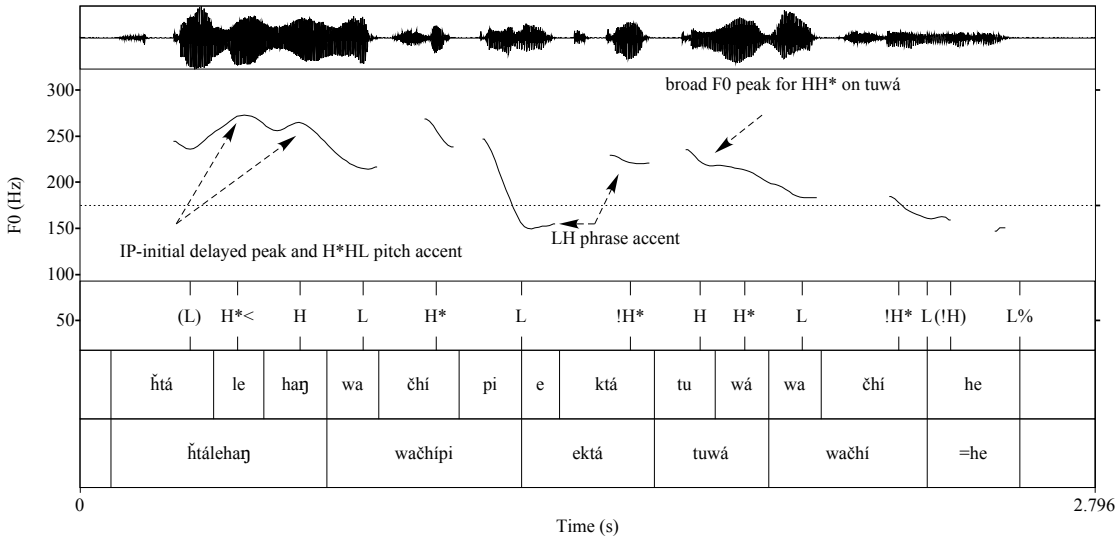


Figure 3.46: Lakota pronominal question tune in a complex clause, with T-word *tuwá* in IP-medial position; example (53).

Figure 3.46 shows many of the tonal features of Lakota utterances that have been discussed in this chapter. I have tried to indicate several prominent tonal characteristics by markings these on the F0 track. The first observation is that the phrase in example (53) starts with a temporal adverb *ȟtálehaŋ* ("yesterday") which shows a delayed peak. The second observation is that this adverb seems to carry an (L)H*H contour; this type of a pitch accent is used frequently at the start of interrogative phrases, as shown earlier.[19] The third observation concerns phrase accents; the postposition *ektá* ("at"), which turns the first clause into a locative adverbial, usually carries a !H* pitch accent. In this position however, the stressed second syllable of *ektá* serves as a docking site for the H tone of a rising LH phrase accent. This phrase accent links the first clause to the main clause, which starts with the T-word *tuwá*.

[19] However, it is also possible that the LH*H contour on *ȟtálehaŋ* is a reflex of secondary lexical stress on the word itself.

3.5.5 Summary of Question Tunes in Lakota

In this section I have shown that Lakota interrogative utterances have several interesting tonal characteristics. Interrogatives are tonally similar to declaratives in terms of general declination and application of downstep. The main distinguishing IP-final feature of interrogatives is that the final question enclitic *he* usually carries a !H phrase accent. Where interrogatives seem to differ from declaratives most is in phrase initial position. The phrase initial major category word in both yes-no and pronominal question tunes usually carries a high level pitch accent, labeled as H*H. Words in IP-initial position in interrogatives that carry an LH* or H*L pitch accent frequently show a delayed peak alignment.

3.6 Summary of Tonal Characteristics of Lakota

Examination of the declarative corpus shows that Lakota has intonational pitch accents that are associated with lexically stressed syllables. The intonational pitch peaks are frequently aligned within the boundaries of the stressed syllable, although, as shown, exceptions exist. The analysis also reveals that Lakota declaratives have two types of edge tones: phrase accents and boundary tones. Analysis of the large-scale tonal properties of Lakota declaratives reveals that there are at least two significant tonal scaling events inside an utterance. One type of scaling is the localized application of downstep which lowers the peaks of subsequent pitch accents and establishes new high levels. The other type of scaling concerns the sudden compression of pitch span in post focal position. In addition to these scaling events, Lakota declaratives also show evidence for overall downtrend, manifested in the form of declination and final lowering. The results from analysis of the interrogative phrases show that question tunes in Lakota exhibit relatively low final boundary tones, similar to declaratives. However, the interrogatives have several outstanding phrase initial tonal characteristics that are distinct from majority of the declaratives. In particular, I have shown that the IP-initial words in interrogatives display (a) high level pitch accents (H*HL) and (b) delayed peaks (H*<).

Chapter 4

The Prosodic Properties of Lakota Utterances

4.1 Introduction

In the previous chapter I considered various tonal characteristics of Lakota intonational phrases, in both declarative and interrogative modalities. In this chapter I describe several aspects of prosodic phrasing in Lakota utterances. More specifically, I explore the prosodic structure of Lakota at and above the level of individual words by considering several phonetic cues that can be used to define degrees of juncture between adjacent units in speech. My goal is to show that simultaneous consideration of boundary strengths at word junctures and tonal characteristics at the phrase level provides a preliminary measure of prosodic phrasing in Lakota. The prosodic phrases I define in this manner are primarily based on phonetic facts. These phonetically defined prosodic phrases have observable phonological consequences, which I consider in some detail.

In order to present the analysis I have organized this chapter as follows: In section 4.2 I provide a brief overview of Lakota prosodic structure at the lexical level and attempt to define the "word" as a unit of analysis. In particular, I discuss how word boundaries may be defined in Lakota and describe several ways in which these boundaries become blurred in connected speech. Next, in section 4.3, I describe the segmental, tonal, durational, and vocal cues that can be used to numerically label strength of boundaries between adjacent words in utterances. In section 4.4 I show that there are correlations between the break

index values, edge tones, and the application of tonal events such as downstep and pitch span compression. Based on these correlations I posit three levels of prosodic structure in Lakota and integrate this finding with the metrical structure of the language. In section 4.5 I discuss the results of a small experiment in which I examined the prosodic phrasing of IP-final enclitics in Lakota. Finally, in section 4.6, I conclude the chapter with a summary of the findings and discuss aspects of Lakota prosodic phonology that remain to be explored.

4.2 The "Word" as a Unit in Lakota: Definitions and Ambiguities

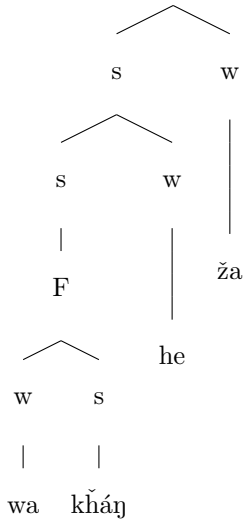
Recall from the description of LaToBI in Chapter 2 (section 2.5.3.3) that one of the components of such a transcription system includes the coding of the degree of juncture between adjacent words in phrases. The coding scheme that I proposed for LaToBI uses a break index system with the range of values {-1,0,1,2,3}. However, in order to mark the boundaries between words with break values it is necessary to be able to first identify the word boundaries. In this section I attempt to define what is understood as "a word" in Lakota. First, I review in some more detail the relation between the placement of lexical stress and words. Then I consider several phonological, morphological, and syntactic factors that complicate the basic definition of a word. I conclude the section with a notion of prosodic word as a unit of analysis for Lakota prosodic structure.

4.2.1 Lexical Stress and "Words"

As summarized in section 3.2.1, the location of lexically stressed syllables is partly predictable in Lakota. Stress in grammatical words generally appears on the second syllable. In metrical phonological notation, the prosodic structure of Lakota words can be represented by a word-level metrical tree. The Dakota Stress Rule (DSR) (Shaw 1985) formalizes the process of metrical tree construction for Lakota. The first step in DSR creates a right-strong maximal binary foot at the left margin of the word. The second

word tree formation step incorporates the remaining syllables to the right of the stressed syllable into a left-branching structure in which the left node is always labeled as strong. For the polysyllabic, second-syllable stress, word *wakȟáŋheža* ("child") the metrical tree can be represented as follows.

Diagram 3



The evidence presented in Chapter 3 indicates that Lakota intonational phrases contain pitch accents that are associated with these lexically stressed syllables. Furthermore, since lexical stress has measurable characteristics - however complex these might be - this suggests that stress, or metrical strength, is a strong indicator for a "word" in Lakota. Namely, a major category word in Lakota is a unit that minimally carries one lexical stress. Certain kinds of bound morphology - such as pronominal prefixes, instrumentals, and reduplication - are added to the base word at the inner lexical phonological levels. The DSR then places the lexical stress on the second syllable of the derived, grammatical, word.[1] Thus, for simple words and for words with only tightly bound prefixes and suffixes the definition of a word as the unit that carries a single DSR stress works well. There are, however, several complications to consider. I turn to these issues next.

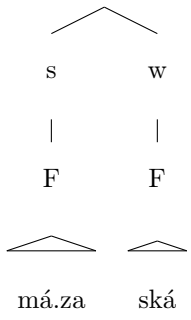
[1] For details of stress placement in derived environments and the place of Dakota Stress Rule within the lexical phonology refer to Shaw (1985).

4.2.2 Identifying Word Boundaries in Compounds

One complication for the definition of a "word" arises from the fact that Lakota contains different kinds of complex compound words. I discussed these compounds briefly in section 3.2.1. Of these, the syntactic compounds and serial constructions, such as those shown in example (6b) and (6c) in Chapter 3, are the more problematic ones for the definition of a word. In these types of constructions, each part of the compound retains at least some of its own stress. In Lakota orthography, the syntactic compounds are generally written as a single word while the serial constructions are written as two separate words. From the perspective of DSR, both syntactic and serial compounds are composed of separate units. Each member of the unit gets assigned a stress by the DSR. Then, at the next metrical level, the words get joined into a larger tree structure.

For syntactic compounds, which are treated as part of the lexical phonology, the individual words in the compound are joined into a larger metrical grid in which the word tree labeling convention "left node is strong" still holds (Shaw 1985:178). This results in a reduced, secondary stress on the second member of the compound. Thus, for a syntactic noun-verb compound such as *mázaská*, "money" = máza ("metal") + ská ("is white"), the metrical word tree at the next level would look like the following.

Diagram 4



Since syntactic compounding takes place in the lexical phonological component, and since the second member has reduced stress, I have generally treated these constructions as single words in the LaToBI coding of word junctures. The main notational feature I have adopted for the syntactic compounds is in the word-tier transcription in LaToBI, in which I write cases like *mázaská* with an internal boundary equal

sign "=" to mark it as a compound, i.e., *máza=ská*. However, I judge these compounds on a case-by-case basis. If, in a given token the two components are pronounced separately with a slight pause, or with no stress reduction on the second member, I transcribe them as separate words, still retaining the "=" sign on the second member.

For the case of serial constructions, the general rule I have followed in LaToBI is to code these as separate words. This is mainly because in serial forms each member generally retains full stress. If, in a given token they are pronounced as attached and the boundary between them is somehow reduced, then I transcribe them as a single word with a hyphen in-between.

4.2.3 Identifying Word Boundaries with Enclitics

A complication similar to compounding arises with respect to the status of post-verbal enclitics in Lakota. Sentence-final verbs in Lakota are often followed by enclitics, and most post-verbal elements belong to this class of enclitics.[2] The enclitics typically express notions of aspect, number, and various types of modality and evidentiality. I have listed some of the Lakota verbal enclitics in table 4.1. These enclitics occur in specified strict order, which is indicated with the integer numbers above each enclitic in the table. Note that this table is not an exhaustive list; there are other enclitics in slots 7, 8, 9 and 10 and many other enclitics in slot 11 (Rood & Taylor 1996: 473). In addition, some of these enclitics have different forms in men's and women's speech.

1	2	3	4	5	6	7	8	9	10	11	12
-haŋ	-pi	-la	ktA	šni	s'a	yo, ye	séčɑ	(k)éya	yelo (decl) s'elel ("like") xcA (emph)	laȟ	he
asp	pl	dim	irr	neg	hab	imp	conj	quot		intsf	interr

Table 4.1: The order of Lakota enclitics. The meanings expressed by each enclitic are indicated with the grammatical gloss abbreviations. For a description of these abbreviations refer to the list in Appendix B.

[2] Two forms of causative constructions in Lakota involve the use of suffix-like items. These are *-yA* and *-khiyA*. These two suffixes appear after the verb, but before the inner *-pi* enclitic. However, these causative suffixes are auxiliary verbs; they attract the pronominal prefixes to themselves. The phrase-final enclitics generally do not have the ability to gravitate prefixes.

The interrogative examples in Chapter 3 show several tokens of the position 12 question marker enclitic *he*. Example (54) illustrates a sentence with four post-verbal enclitics.

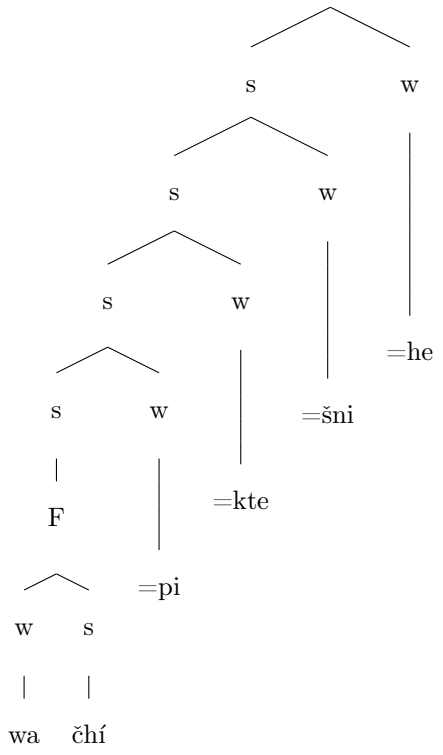
(54) wačhí-pi =kte =šni =he

dance-pl =irr =neg =interr

"Aren't they going to dance?" [Speaker DBW09:SC]

In Siouan linguistics these enclitics are treated as an outer layer of suffixation. The metrical model of Lakota lexical phonology proposed by Shaw (1985) places all the enclitics unanimously as part of the outer layers of word formation. In terms of the metrical tree, the enclitics are incorporated into the word with the word tree construction rule "left is strong", leaving intact the strong initial foot established by the DSR. For instance, the series of four enclitics shown in example (54) can be represented with a metrical structure as follows.

Diagram 5



There are good reasons for treating the enclitics in this manner. First, many of the enclitics do not carry primary stress. Second, there is a set of lexical phonological rules, such as ablaut, that apply to enclitics. However, treating the enclitics unanimously as a single set ignores the fact that there are several differences between the members in the group. One difference concerns the way in which the various enclitics behave in terms of relative attachment to the head verb. Enclitic *-pi* frequently reduces to [p] or [b], closing the final syllable of the head verb and gluing onto it like a suffix. The post-*pi* enclitics do not display this kind of reduction. In example (54), as elsewhere, I have tried to code the more suffix-like property of *-pi* by preceding it with a hyphen rather than the standard enclitic boundary marker "=". Another outstanding difference between the enclitics is found in the domain of lexical stress. Some of the extremely outer layer enclitics, such as *séča* and *kéya*, carry their own lexical stress.

In my transcriptions, therefore, I have treated *-pi* and the single enclitic that comes before it, *-haŋ*, as suffixes. The other enclitics, which come after *-pi*, are transcribed as more independent, "word"-like, forms. If an outer layer enclitic is perceived with lexical stress, I transcribe it as stressed on the appropriate syllable. In the LaToBI transcriptions, I segment the post-*pi* enclitics as separate items in the word tier. This automatically implies that I also assign a break index value at their boundaries, coding how detached or attached they sound relative to what is around them. I discuss the status of enclitics in more detail in section 4.5, when I describe the enclitic experiment.

4.2.4 Phonological Changes in Fast Speech

Lakota words exhibit several sound changes in ordinary fast speech, termed *ikčéya wóglakapi* by native speakers. Fast speech forms, as expected, often involve reduction, weakening, elision, and a higher degree of co-articulation between adjacent sounds. Changes can take place both inside words and in between words. Here I only summarize the word boundary alternations since these are the types of changes that primarily affect the word-juncture identification and LaToBI word-boundary labeling scheme. Full discussions of all Lakota fast speech phonological changes can be found in Rood & Taylor (1996) and Ullrich (2008).

4.2.4.1 Loss of /w/ and /y/

In the sequences /VwV/ and /VyV/, the glides have a weaker pronunciation in fast speech. At the juncture of two words this can happen when the first word ends in a vowel and the second word begins with a /wV/ or a /yV/ syllable, giving rise to [V wV] or [V yV] sequences at the word boundary. The resulting co-articulation in fast speech depends on what the vowels are and which glide is present. Generally, /w/ weakens when it occurs after one of the back vowels /o/, /u/ or /uŋ/ and /y/ weakens when it occurs after one of the front vowels /e/, /i/ or /iŋ/. In these contexts the glide drops and the resulting vowels are pronounced in sequence. In the context of the low vowel /a/ the reduction of glides sometimes gives rise to a new vowel quality. The reduction of the glide /y/ in sequence [aye] results in a long, low vowel [æː], while the reduction of /w/ in sequence [awa] results in a long central mid-back [ɔː]. If there are nasalized vowels around, the nasalization usually prevails in the newly formed vowel. An example of the loss of glide /w/ in an [áŋ waŋ] sequence, between a noun and the accompanying article, is given in example (55). Compare the first, phonetic transcription, line with the second, slow speech phonemic, line.

(55) *šúŋkɔːkȟɔːŋ* *mak'úpi...*

šúŋka=wakȟáŋ =waŋ ma-k'ú-pi

horse$_{COMP}$ DET$_{indef.real}$ 1sg.pat-give-pl

"They gave me a horse." [Speaker PRS73:N]

4.2.4.2 Unstressed Word-Final Vowel Loss

In fast enough speech in Lakota any unstressed, word-final vowel can be dropped. Unstressed vowel loss is, however, more common in certain morpho-syntactic constructions. Vowel loss between words is quite common and often results in the words being pronounced as more attached together. Some examples are listed in (56) below.

(56)

	Slow Speech	*Fast Speech*	*gloss*
a.	hená iyúha	heníyuha	"all of those"
b.	táku tokȟá =he	tág tokȟá =he	"What happened?"

Further sound changes, such as /k/ becoming [g] in (56b.), frequently accompany final vowel loss. Final vowel-drop is very frequent in the database for this study, especially in the monologue narrative tasks. The inter-word vowel loss constitutes a weakening of the juncture between adjacent words. I have coded these reductions both in the syllabic/phonetic tier and in the break index tier, whenever applicable.

4.2.4.3 Weakening of /h/ and /'/

The glottal phonemes are also frequently dropped in fast speech when they occur between vowels. The environment for this change is similar to the glide weakening described above. However, the results of the change are not the same. The glottal sounds typically do not alter the quality of the contacting vowels when they drop. In fast enough speech, an inter-word sound sequence such as [a 'í] can be simplified to [aí]. The same elision and vowel attachment occurs with inter-word h-loss.

4.2.4.4 Replacement and/or Contraction of Enclitic -pi

The suffix/enclitic *-pi* is one of the most variable elements in Lakota fast speech. If *-pi* is in clause-final position, or if it occurs in the context of some of the other enclitics that are positioned after, it frequently reduces to /b/ or /p/. Instances of the clause-final contraction of *-pi* can be seen in the phrases shown in example (11), in section 3.3.1. In the enclitic context, this particular contraction of *-pi* happens very frequently when it is placed before *=šni* or *=he*.

If *-pi* is treated as a suffix, then its contraction alone does not pose a large problem for word-boundary identification. The contraction of *-pi* has a more severe effect when it occurs in the context of other sound changes. In natural speech for instance, it is not uncommon for coordinate or, even independent, clauses to be pronounced with some degree of attachment. These types of clauses are sometimes joined together by a phrase accent that combines them into a long utterance. Under such circumstances it is possible for several fast speech phonological changes to apply at the same word juncture. Example (57), from speaker PRS, illustrates a situation in which (i) an intervocalic /y/ between the words *lápi* and *yuŋkȟáŋ* is lost, and (b) the final vowel of *-pi* on the word *lápi* is also elided. As a result, the slow speech sequence with a clear word boundary [pi yuŋ] is replaced by [puŋ:]. Compare the first, narrow transcription, line with the second, slow speech phonemic, line in example (57). Also note the more standard simple contraction of *-pi* to /p/ before the enclitic *=šni* at the end of the second clause.

(57) *wígli: lápuŋ:kȟáŋ* *wičhák'up* *šni* *...*

wígli lápi yuŋkȟáŋ wičhá-k'u-pi =šni ...

gas ask-pl but then$_{CONJ}$ 3pl.pat-give-pl =neg

"They asked for gas but then they didn't give it to them." [Speaker PRS73:N]

The suffix/enclitic *-pi* displays another kind of complicated contraction in which it gets replaced by a vowel when it occurs before the enclitics *=kte* and *=kštó*. This contraction also happens before the conjunctions *na* and *naháŋ*, and also before the particle *=kiŋ*. The vowel that replaces *-pi* is determined by the final vowel in the preceding verb to which *-pi* has attached. I will not pursue this particular sound change any further here since *-pi* is already treated as a suffix in my analysis. For details on all the various contractions of *-pi* refer to Ullrich (2008:771-72).

4.3 Analysis of the Phonetic Correlates for the Break Indices

Within an utterance in connected speech, in any language, some words prosodically group together more than others. In general, the boundaries between words can be highlighted by rhythmical hesitations, pauses, lengthening, and intonation. This was shown experimentally in the production and perception experiments by de Pijper & Sanderman (1994). In this section I describe four types of phonetic cues that can be used to identify boundary strengths between Lakota words. One type of cue involves the application versus non-application of the word-juncture sound changes that were described in section 4.2.4. The other three types of cues I consider are suprasegmental in nature. Two of these involve tone and duration, while the last one involves certain laryngeal features that are observable at word boundaries. In what follows I first describe the compiled data subset that I have used for the analysis of word junctures presented here. Then, I present the segmental and suprasegmental cues to word boundary strengths in Lakota by providing a detailed discussion of several illuminating examples from the dataset. The presentation of these examples shows how I have used the phonetic correlates to label word junctures with the LaToBI break index values. I conclude the analysis by considering general trends in the data which show that, most of the time, the break indices are a reliable measure of prosodic distance between adjacent words. There are several ambiguities that I address in the discussion.

4.3.1 Data Subset for Analysis of Word Junctures

The entire database described in section 2.3.1 has been coded for word boundary junctures. I have compiled a subset of utterances from this database for the presentation of the Lakota word boundary analysis in this section. The intonational phrases in this subset are from the three spontaneous narratives: PRS73, SOF73, and DBW06. I have limited the current analysis to the narrative data because these tasks represent continuous speech in which cross-IP tonal and durational observations are possible. These narratives are also the portion of the data with the least number of abrupt cutoffs. However, as I show later in this chapter, the analysis of boundary strengths presented here can be extended to the other parts of the database as well.

4.3.2 Segmental Cues: Coalescence and Apocope

I first consider the segmental cues at word boundaries that signal prosodic proximity between adjacent words. Example (58) shows a short Lakota intonational phrase consisting of a type of serial verb construction. In this example the phrase-medial word boundary between the two verbs is very clearly pronounced. This clear boundary is visible both in the waveform and the spectral representation shown in figure 4.1.[3] In the LaToBI break index tier, also shown in the figure, I have labeled the juncture between these verbs with break index (BI) value zero.[4]

(58) slolyá-pi čhíŋ-pi

know-pl want-pl

"They wanted to know." [Speaker PRS73:N]

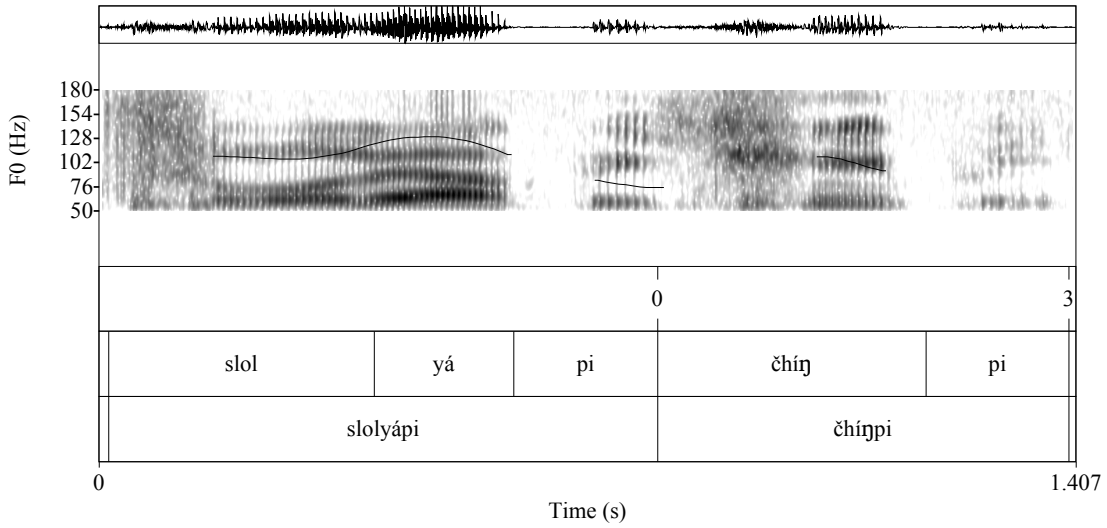


Figure 4.1: An intonational phrase with phrase medial BI=0 juncture.

[3] Several of the figures in this section have the F0 pitch track overlaid on a spectrogram.

[4] The final, right margin, boundary value BI=3 in this figure corresponds to the intonational phrase boundary. I discuss these in section 4.3.3.

Recall from Chapter 2, section 2.5.3.3, that the "unmarked" value of juncture between two adjacent words, W_1 and W_2, in continuous speech is defined by break value BI=0. That is, when the pronunciation of W_1 and W_2 in a phrase is "as expected", the juncture between the words is unmarked. This means several things. First, none of the fast speech, boundary erasing phonological reductions discussed in section 4.2.4 have taken place between W_1 and W_2. In addition, BI=0 implies that the right boundary of W_1 is not lengthened or followed by a hesitation, and does not receive final lowering or creaky phonation. Looking back at figure 4.1, it is clear that the boundary between the two verbs meets all these conditions; hence the BI=0 juncture value.

Not all word junctures are, however, as clear as what is seen in example (58). Typically - and especially if the speech rate is mildly fast - phonological reduction processes can take place. These reductions partially erase the clear boundary between adjacent words. Example (35) from section 3.4.1, repeated below in (59), shows a phrase that contains at least two cases of word-boundary weakening. The first one occurs between a phrase-initial noun and its article. It involves anticipatory co-articulation of the glide /w/ at offset of the noun *obláye*. The second, more drastic, reduction occurs between the postposition and the verb, where the expected default sequence [tá uŋ] becomes [túŋ]. The prosodic distance between these words can be considered as smaller than normal, due to loss of expected phonetic material at the juncture. Such negative junctures are coded in LaToBI with BI=-1. The reduced word boundary between *ektá* and *uŋthípi* in figure 4.2 illustrates the BI labeling convention that I have used in my analysis; the BIs are coded relative to boundaries on the word tier (i.e., relative to what is "expected" under clear boundary conditions) and not relative to the phonetic tier. Finally, note from figure 4.2 that the boundary between the offset of the article *=waŋ* and onset of *ektá* is not erased; this juncture is labeled with the expected BI=0 value.

(59) *(o)blǽwaŋ ektúŋ thípi*

obláye =waŋ ektá uŋ-thí-pi

flat.land $\text{DET}_{indef.real}$ at_{PP} 1.nsg-live-pl

"We lived at a level place on the prairie." [Speaker SOF73:N]

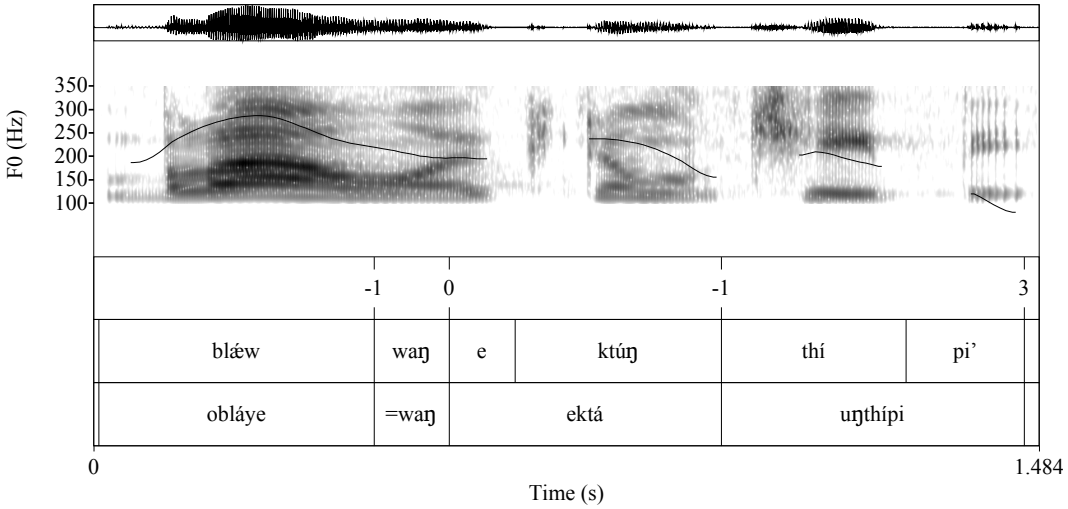


Figure 4.2: Phrase with two BI=-1 junctures, cued by segmental reduction processes; example (59)

As pointed out earlier, in Lakota, not all word-edge sound reductions result in a negative juncture. Reduction of the word final suffix/enclitic *-pi* to [b] or [p] is a very frequent phenomenon in this dataset. Example (60) shows an utterance from one of the narratives in which two reductions of *-pi* have taken place. The first case of *-pi* reduction is in phrase-medial position and the second one in phrase-final position. However, at least in this example, these reductions do not weaken the word boundaries significantly. In the phrase-medial case of *-pi* reduction there is no perception of blurring of word boundaries. The verb *ptaíč'iyab* and the conjunction *našná* do not show co-articulation of boundary segments either. The break index value between the *ptaíč'iyab* and *našná* is marked as zero. Other sound changes would have to co-occur in order to weaken the audible word boundary. I discussed a case of multiple sound changes along with *pi*-reduction in example (57), in section 4.2.

(60) *ptaíč'iyab našná .. wíkignib*

pta-íč'i-ya-pi našná wa-i-kí-gni-pi

gather-refl-caus-pl and$_{CONJ}$ indef.obj-pos$_{infix}$-search-pl

"They gathered and hunted for food." [Speaker DBW06:N]

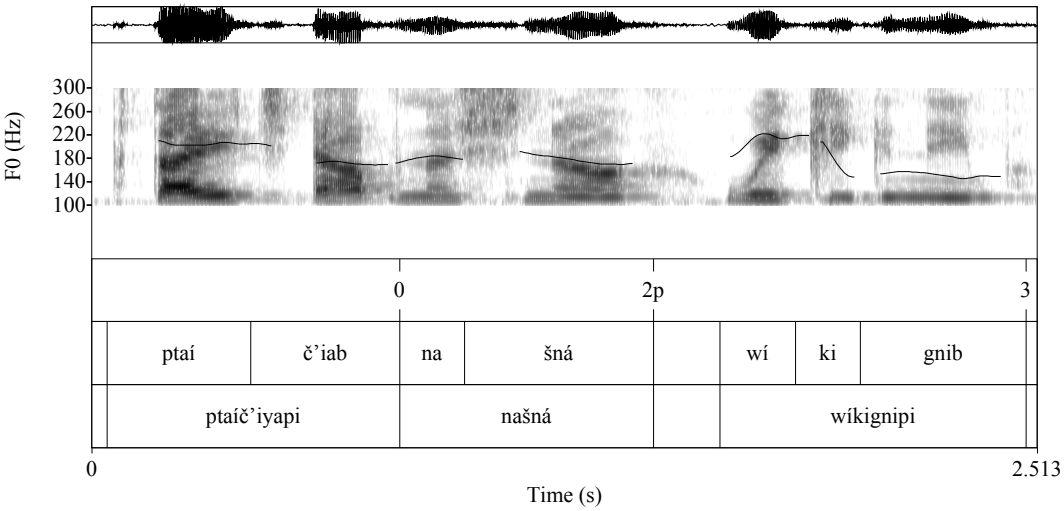


Figure 4.3: Example where reduction of *-pi* to [b] leaves the BI=0 juncture intact.

The observations in this section suggest that sound changes involving phonetic and phonological reduction generally highlight negative boundary strengths (i.e., situations in which the prosodic distance between adjacent words is shortened). When adjacent words are in contexts where their prosodic distance is relatively increased, accumulation of suprasegmental cues is a better measure of the boundary strength.

4.3.3 Suprasegmental Cues to Boundary Strengths

Careful phonetic analysis of adjacent word boundaries inside intonational phrases in the data provides information concerning the larger prosodic cues that are associated with word-juncture boundary strengths. In this section I present the results of my observations on word boundary strengths by walking through the

phonetic details of word junctures in several Lakota phrases. I first describe the types of suprasegmental cues that I have considered. Then I discuss the results of the analysis of inter-word boundaries based on the presence or absence of these suprasegmental cues at word-word junctures. The observations suggest that the chosen suprasegmental cues can indeed be used systematically as a means of evaluating boundary strengths between adjacent words.

4.3.3.1 The Suprasegmental Observables

If we consider again two words, W_1 and W_2, in sequence in connected speech, there are various suprasegmental observations that can be made at the juncture of the words. In this analysis I have considered three types of suprasegmental parameters. These are duration, tone, and laryngeal features. The durational correlates for prosodic distance at the juncture between two words typically involve lengthening phenomena. I examine two types of lengthening at word boundaries. These are (i) pre-boundary lengthening on word W_1, and (ii) a hesitation, slowing of tempo, or a slight pause between W_1 and W_2. With respect to tone, I also consider two observables. These are (i) continuity versus discontinuity of tune across the juncture, and (ii) pitch reset at the juncture. In addition, I consider one laryngeal feature, namely, glottalized or creaky fall, that sometimes adds to the perception of a stronger boundary between words.[5]

4.3.3.2 Lengthening, Pause, and Tone

Below I use an example of one long phrase from the data to illustrate how several suprasegmental parameters, along with proper phonetic measurements, allow for a quantification of boundary strengths between Lakota words in connected speech. Since the phrase I am using is long I have broken it up the example into two portions. Figure 4.4 displays the first part of the phrase and figure 4.5 displays the second

[5] Creaky fall is a voice quality and arguably not suprasegmental. Furthermore, I have not treated the glottal stop as a suprasegmental cue for junctures here. This is because I have assumed that Lakota has a glottal stop phoneme (see table 2.3). In addition, the declarative glottal stop is a morpheme that acts as an enclitic-like entity at IP-final position in some declaratives, as discussed in Chapter 3. On the other hand, the glottal stop is sometimes phonetically inserted between VV sequences, a process that takes place at word junctures as well. The phonemic versus phonetic uses of the glottal stop need more investigation. I cannot pursue this issue further in this study.

part. I discuss each of these separately and explain how they are connected to each other. The entire phrase discussed consists of the utterance shown in example (61).

(61)	yuŋkȟáŋ	lé	aŋpétu	=waŋ	él	**Part I**
	and$_{CONJ}$	this$_{DEM}$	day	=DET$_{indef.real}$	on$_{PP}$	
	wičháša	=ki	wakhúl-iyáya-pi			**Part II**
	man	DET$_{def}$	hunt-set.out-pl			

"And then, this one day, the men went out hunting." [Speaker DBW06:N]

In the portion labeled Part I in example (61) there is a pre-boundary lengthening plus a short pause that occurs in between the noun, *aŋpétu*, and its article, *=waŋ*. Figure 4.4, corresponding to Part I in example (61), shows the wave, pitch track with tone marks, and the break indices, all lined up with the syllables and word boundaries. The perceived juncture between *aŋpétu* and *=waŋ* is stronger than the default (zero) word boundary, mainly because of the lengthening and pause. The LaToBI break index value I have used at this juncture is BI=1p. The letter "p" after the BI value explicitly codes the existence of a pause at the word boundary.[6] The pitch track of Part I of example (61) also displays interesting tonal properties. In particular, note in figure 4.4 the rising LH phrase accent that spans the last three syllables. The final syllable of *aŋpétu* is at a low trailing level, L, and from there the tone steps up across *=waŋ*, and steps up again onto *él*. *waŋ* and *él* are pronounced in the expected, unreduced forms and do not display lengthening and pauses between them. The break index value I have used at this boundary is BI=0g. The letter "g" indicates that there is an onset glottal stop in between, presumably belonging to the vowel-initial word *él*. The tone ends on a flat, downstepped high, level, at a value of F0=200 Hz. After the offset of *él* there is a significant pause of about 750 mili-seconds before the next word is uttered.

[6] Refer to Chapter 2, section 2.5.3, for explanation of the BI coding scheme.

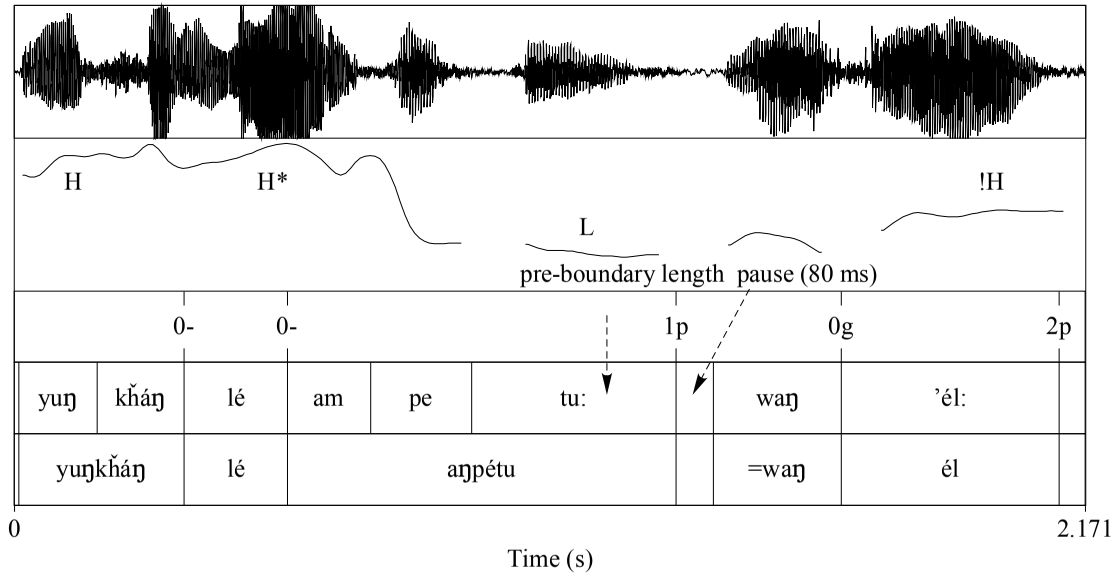


Figure 4.4: Pre-boundary lengthening and short (80 ms) pause between the noun and the article in Part I of example (61). These durational cues give a sense of stronger juncture, marked by BI=1p. Also notable is the LH rising phrase accent on the last three syllables. The F0 value at the very end is 200 Hz.

Part II of example (61) is displayed in figure 4.5. The first tonal observation to make is that the F0 of part II starts at 207 Hz, very close to where part I left off. Perceptually, there is almost no tonal discontinuity across part I and part II, despite the long pause between them. There is also no significant F0 declination in part I, and the boundary between part I and part II does not display a clear declination reset. Because of the lengthening at the end of part I, the pause between the two parts, and the phrase accent at the end of part I, the juncture between *él* (end of part I) and *wičháša* (start of part II) is strong. On the other hand, tonal continuity between part I and part II and the lack of declination reset at the juncture indicate that, although the boundary is strong, there is still some sense of continuity. I have coded this in the break index tier by marking the boundary of *él* with BI=2p. Again, the "p" diacritic here indicates that there is a post-boundary pause at the juncture.

Several other interesting suprasegmental features within part II are noted in figure 4.5. The boundary between *=ki* and *wakhúl* is markedly strong due to both durational and tonal cues. The article *=ki* exhibits pre-boundary lengthening and is followed by a short hesitation (38 milli-seconds). Furthermore, it carries an L phrase accent in utterance-medial position. The boundary between *=ki* and *wakhúl* is therefore marked with BI=2p. After the last major pitch accent on *wakhúl*, the F0 drops to the speaker's low baseline and stays in that compressed, low pitch span until the end of the utterance. Several things happen toward the end. The second member of the serial verb construction, *iyáyapi*, is de-accented; there is no significant pitch movement near its stressed syllable. The suffix/enclitic *-pi* exhibits final lengthening, while the pitch stays flat and ends at this speaker's baseline, at about 148 Hz. The end of part II is perceptually strengthened further by the presence of a pause.

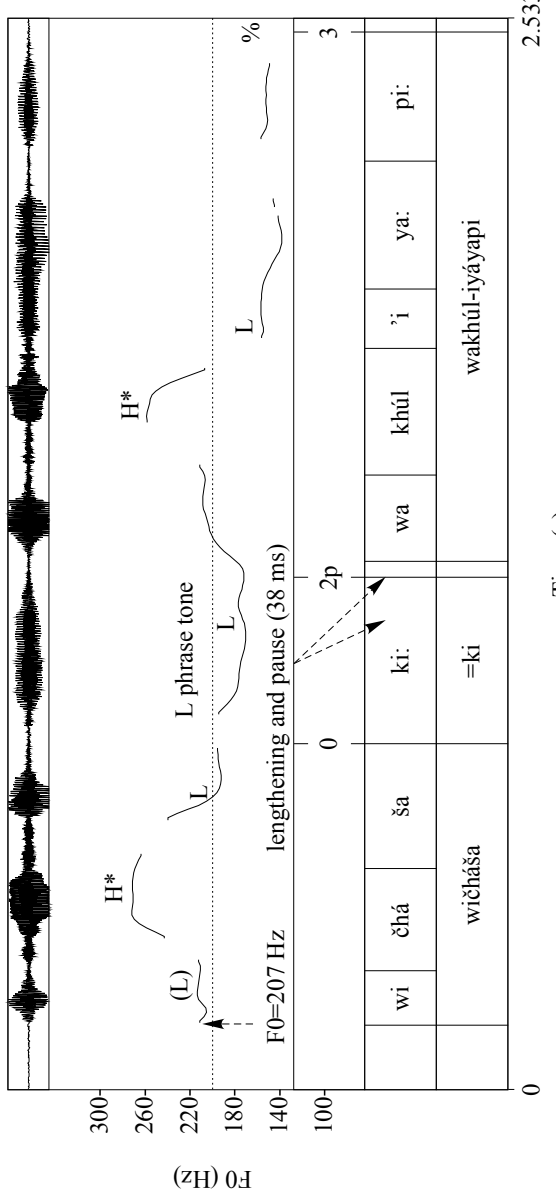


Figure 4.5: Tonal continuity, and more cases of pre-boundary lengthening and pause, in the second part of the utterance in example (61).

Examination of the start of the immediate next phrase in the narrative - displayed in figure 4.6 - shows that pitch and declination have reset. The initial pitch at the start of the next word is 211 Hz, and the slope of the global declination is at a new value. The combined tonal and durational cues at the end of *iyáyapi* are indicators of a boundary which is even stronger than the boundary between part I and part II. The break index value I use at the edge of *iyáyapi* is therefore one step higher, (i.e., BI=3).

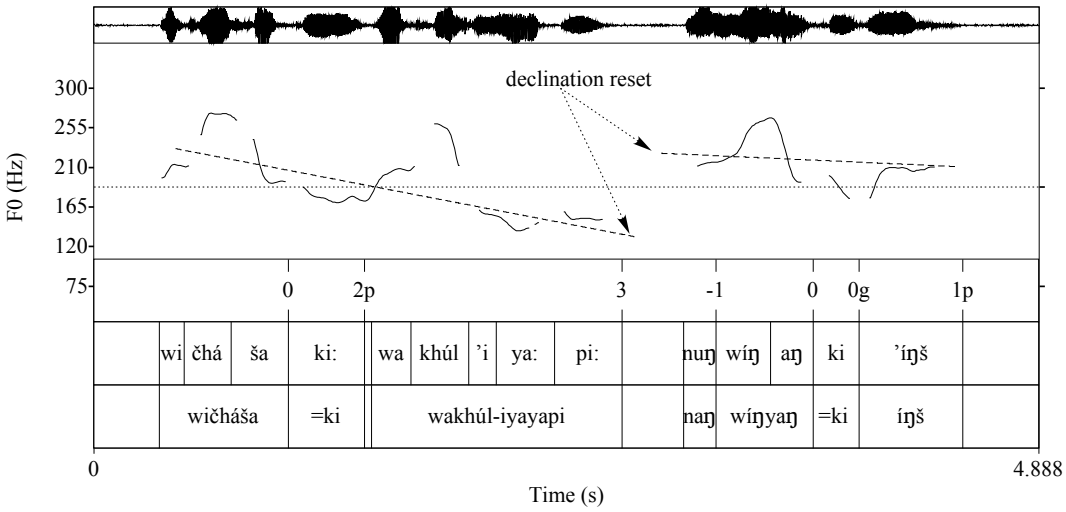


Figure 4.6: End of the entire intonational phrase in example (61) marked by pre-boundary lengthening, pause, tonal discontinuity, and pitch reset at the start of next utterance. The dashed lines are fitted declination curves to each phrase.

4.3.3.3 Laryngeal Cue: Creaky Phonation and Glottalization

The only remaining juncture feature to describe here is the laryngeal cue. The laryngeal feature has a limited distribution, occurring most frequently toward the edges of phrases. Generally it takes the shape of either creaky phonation or a similar type of glottalization. This glottalization does not occur in the context of utterance-medial phrase accents in the data. Furthermore, trends from the data indicate that in final position the laryngeal cue usually accompanies other phonetic observables, such as boundary tones, pre-final lengthening, and pitch reset, all of which signal a strong juncture. Figure 4.7 shows an example of final glottalization on the suffix/enclitic *-pi*, near an L% boundary tone.

(62) eháŋni waŋblí hoȟpí él ma-tȟúŋ-pi

long ago Eagle Nest at$_{PP}$ 1.sg.pat-give.birth-pl

"Long ago I was born at Wanblee, South Dakota." [Speaker DBW09:N]

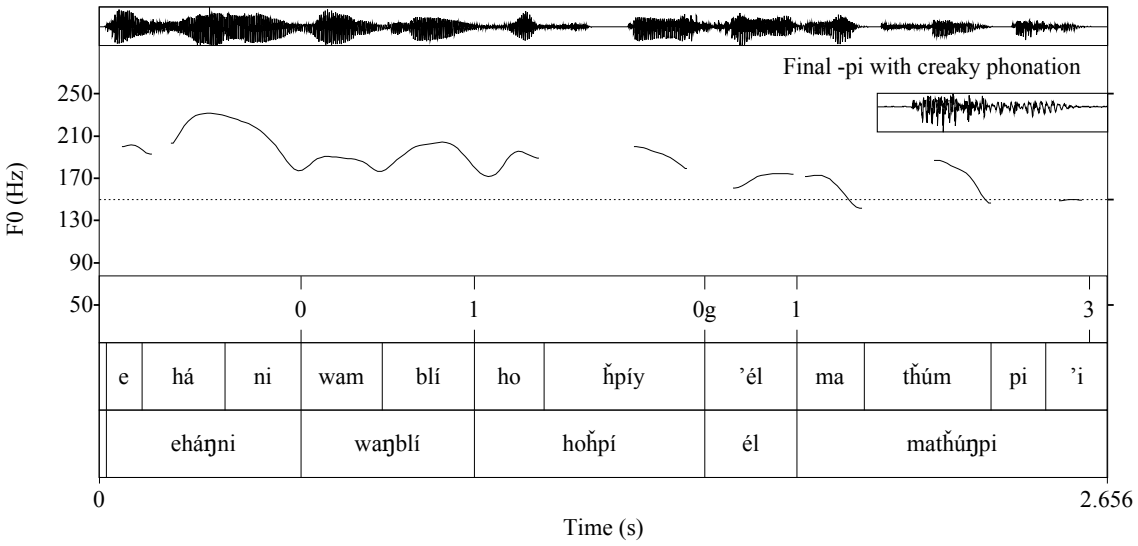


Figure 4.7: Intonational phrase in example (62), displaying creaky phonation on final suffix/enclitic *-pi*. The right side inset panel shows a closeup of the jitter in the waveform during the final [pi] syllable.

The partial-phonetic transcription on the syllable tier in figure 4.7 also displays an interesting feature of the boundary glottalization that some speakers use. Note that the phrase final *-pi* is phonetically transcribed as [pi'i] on the syllable tier. That is, in addition to glottalization there is a post-glottal echo vowel. This echo vowel appears frequently in contexts of final glottalization and creaky voice for speaker DBW. The echo vowel is low in pitch and can also be partially or fully devoiced.

Sometimes there are drastic phrase-final pitch falls that reach a very low F0, without exhibiting the typical frequency jitter that is associated with creaky phonation. This extreme fall, without creak, was observed only in the speech of speaker SOF in this dataset. Finally, creaky phonation and glottalization are also sometimes used in the context of self-repair cutoff. These cutoffs are generally very abrupt interruptions

of a phrase-in-progress and, therefore, correspond to a high degree of juncture introduced into the flow of speech. I have not analyzed these additional forms and functions of phonation in the current study.

4.3.4 Discussion of Results: The Break Index Measure

4.3.4.1 Measuring Boundary Values

The durational, tonal, and laryngeal events described in section 4.3.3.1 consist of five phonetic cues at word junctures that can be observed and measured. As shown by the examples from the data, several of these cues can co-occur at the same [W_1 W_2] juncture. These observations imply that, as a starting point, one can formulate a simplified model of boundary strengths based on the *number* and *types* of phonetic cues present at prosodic junctures. In other words, a preliminary notion of prosodic distance between adjacent words W_1 and W_2 may be defined simply in terms of the total number of phonetic cues for boundary strength that are observed at the juncture of the two words.[7] The general trends from the data indicate that when the number of phonetic correlates at the boundary goes up, the perceptual strength of the juncture increases. From the set of five suprasegmental correlates, creaky phonation exhibits the most limited distribution, as discussed. If, for the moment, we ignore the laryngeal cue and consider only the presence (+) or absence (-) of the four tonal and durational correlates, there are 16 possible combinations of cues for a given juncture.[8] However, there are co-occurrence restrictions amongst the various cues and several combinations of cues appear to be very infrequent. For example, in the dataset used here, tonal discontinuity does not always imply pitch reset at a juncture. On the other hand, a final fall plus pitch reset at a juncture always implies tonal discontinuity. These co-occurrence predictabilities restrict the total number of combinations to a smaller set.

[7] I do not intend to suggest that there is no hierarchical relationship among the various cues that mark levels of juncture. It is possible that some cues contribute more to the perception of a stronger boundary, or that some cues only occur in certain contexts. The idea here is to start with some *simple* working assumptions that will allow for a *quantifiable* model of word juncture boundary strengths. This model can be improved upon later to take into account hierarchical relationships.

[8] This number follows from the various combinations of +/- for four variables.

$$n = \sum_{j=0}^{4} \frac{4!}{(4-j)!j!} = 2^4$$

Some of the most frequently occurring combinations of durational, tonal, and laryngeal cues in the data are listed in table 4.2. The last column, "BI Value", shows the LaToBI break index value that I have typically assigned at the juncture, given the presence (+) of the boundary correlates in that row. When none of the suprasegmental cues are present, as in the first row in table 4.2, two adjacent words W_1 and W_2 either have a negative juncture (discussed in section 4.3.2) or are pronounced with "expected" clear boundaries. When all five suprasegmental cues are simultaneously present, as in the last row in table 4.2, then W_1 and W_2 are maximally separated, and, in practice, are either separated by an intonational phrase boundary, or W_1 has ended with an abrupt cutoff.

Durational		Tonal		Laryngeal	LaToBI
Lengthening	Pause	Discontinuity	Pitch Reset	Creaky Fall	BI Value
-	-	-	-	-	0 or -1
+	-	-	-	-	1 or 2
-	+	-	-	-	1p or 2p
-	-	+	-	+/-	1p or cutoff
+	+	-	-	-	2p
-	+	+	-	-	1p
+	+	+	-	-	1p
+	-	+	+	+	3
+	+	+	+	-	3
+	+	+	+	+	3 or cutoff

Table 4.2: Frequently occurring combinations of durational, tonal, and laryngeal cues. Presence (+) or absence (-) of all five of the suprasegmental boundary have been considered. The rightmost column represents the possible break index value, given the correlates in that row. A mixed "+/-" symbol for a cue indicates that the stated BI value is used, whether that particular cue is present or not.

Table 4.2 is not an exhaustive list of all possible phonetic cues to word junctures. Some of the consequences of this limitation are as follows. First, the mapping between LaToBI break indices and the presence or absence of cues is not always simple or one-to-one. Sometimes a given set of prosodic cues can be interpreted with two different break index values. Second, there are some situations in which different prosodic cues to boundary strength lead to conflicting decisions on what break index value to code at the juncture. In such situations, the decision of what break index value to use may need to be based on other impressionistic or phonetic grounds that are not included in the table. I discuss the details of some of these coding ambiguities next.

4.3.4.2 Ambiguities and Labeling Mismatches

Table 4.3 displays the number of tokens of each type of LaToBI break index value {-1, 0 or 0p , 0-,1 or 1p, 1-, 2, 3} that were coded at word junctures in the data subset used here. Break indices 0 and 0p are the most frequent ones, coding the standard word juncture. Break index values 2 and 1 typically correspond to a juncture that contains slight lengthening and/or an associated phrase accent. Break index value 3 typically codes situations with discontinuity and pitch-reset.

Narrative		-1	0-	0 or 0p	1-	1 or 1p	2 or 2p	3
DBW06		2	12	47	0	19	20	24
SOF73		7	10	26	3	10	12	16
PRS73		5	2	39	1	11	19	15
Total:		*14*	*24*	*112*	*4*	*40*	*51*	*55*

Table 4.3: Token counts for each LaToBI break index value in the three narratives used for juncture analysis. The data here represent a total of 61 intonational phrases.

Several ambiguities between the break index coding and the prosodic boundary strength can be deduced from table 4.3. The total number of BI=3 indices in table 4.3 is 55. Yet, the total number of intonational phrases coded for this analysis, from all three narratives, is 61. This implies that there are at least six ambiguous cases. These ambiguities occur when one of the expected, standard, cues for the larger IP boundary is missing, or when there are mismatches between the various cues that are present.

Example (63) illustrates a situation in which there is a mismatch between the prosodic cues at the word boundary of a conjunction, *na*, that connects two clauses. The word-offset juncture at *na* displays a feeling of discontinuity due to (a) the higher pitch level of the next pitch accent and (b) the perception of a weak glottal stop at *na*-offset position. Although not clear, there might also be some declination reset after *na* which is difficult to quantify unambiguously. On the other hand, a near well-formed tune - without pauses or lengthening - continues across the juncture. According to the LaToBI convention outlined in Chapter 2, I have marked the boundary strength at *na* with BI=1. In this case the break index value is used to indicate that the juncture is stronger than the standard word boundary strength of zero, but that there are conflicting cues as to how strong the juncture is.

(63) hená súŋ-pi na waníyetu čháŋna hená yúta-pi

these dry-pl and$_{CONJ}$ winter$_{V-IMP}$ then$_{ADV}$ these eat-pl

"They dried these and when it was winter they ate them." [Speaker SOF73:N]

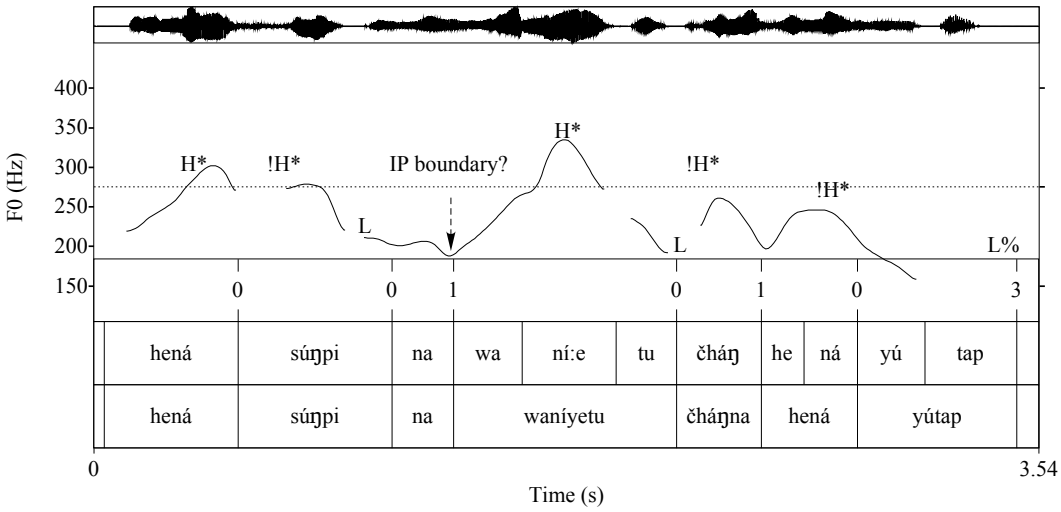


Figure 4.8: Mismatch between phonetic correlates for an IP boundary in example (63). There is no lengthening, pause, or significant pitch drop at the offset of the conjunction *na* (marked by arrow). There is no clear tonal discontinuity, yet the speaker starts a new pitch level after the conjunction. Also, at the slight dip in the F0 track marked by the arrow, there is a very weak glottal stop.

Example (64), displayed in accompanying figure 4.9, illustrates another token with ambiguities. There are three potential cues for the presence of a strong word juncture at the offset of the demonstrative particle *hé*; lengthening, pause, and sudden pitch drop with near-creaky phonation. However, perceptually, the creaky voice sounds like a cutoff. Furthermore, there is no clear indication of a declination reset in the tonal contour in figure 4.9. As discussed earlier, in the context of the example in figure 4.6, declination reset generally accompanies strong IP junctures in this Lakota dataset. Since the strong tonal reset cue is missing at *hé*-offset position in example (64), I have labeled the juncture at this point with break index BI=1p (instead of a stronger IP value, BI=3). The BI value *1p* here serves to indicate that there is a strong juncture with a pause, but that some of the expected cues for a high boundary strength are missing.

(64) aŋpétu-wakȟáŋ =ki hé ú=kte ki

day-sacred DET_{def} $that_{DEM}$ arrive=irr DEF_{rel}

"When that Sunday would come... " [Speaker SOF73:N]

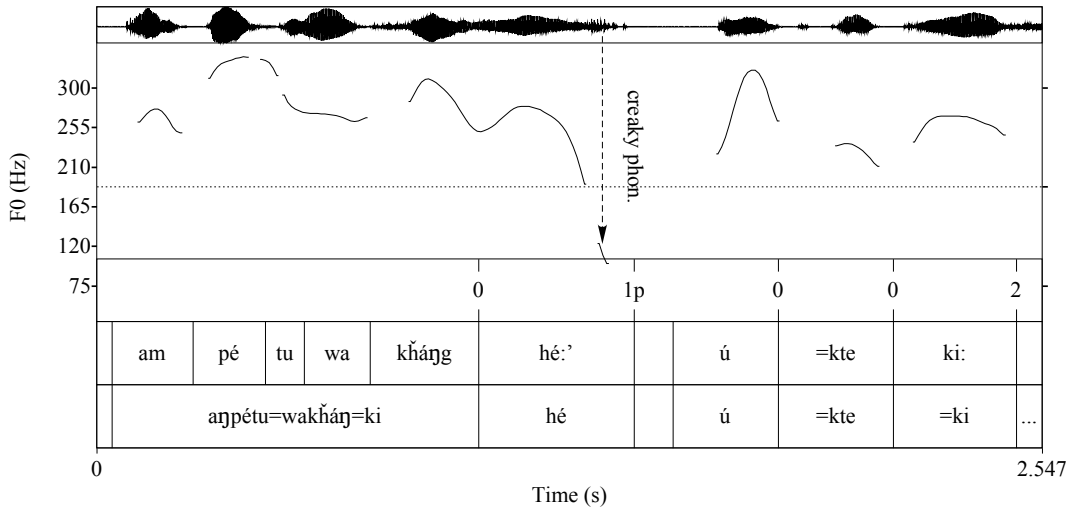


Figure 4.9: Mismatch between phonetic correlates for an IP boundary in example (64). There is lengthening and pause at the offset of the word *hé*, as well as a near creaky phonation. However, there is no obvious declination reset. Cases like these are marked with a % boundary, but the labeling convention in LaToBI requires a BI=1p at this juncture.

Despite such ambiguities, the general trends in the Lakota data used for this analysis reflect a positive correlation between perceived boundary strength and the number of segmental and suprasegmental cues that are observable at word-word junctures. The phonetic cues of duration, tone, and laryngealization are good indicators of prosodic distance between words in majority of the cases where the intonational phrases are relatively easy to identify. I provisionally accept the positive tendency as an indication that the break index system can be relied on as a representative measure of boundary strengths. In order to test the validity of the coding system empirically one would have to use data from more speakers and have different transcribers code the same set of data to check for consistency.

4.4 Prosodic Phrases in Lakota

In this section I synthesize the results from the prosodic boundary strength analysis with the postlexical phonological and tonal characteristics of Lakota. The synthesis reveals a layered prosodic structure for Lakota phrases. I start at the highest level, the intonational phrase, and work to the lowest level, the "word", and show how the results of the data analysis provide evidence for the proposed prosodic structure. The Lakota prosodic constituents I propose here are based on tonal and phonetic observations from real speech data. They are not based on any generative style phrase building mechanisms.

4.4.1 The Intonational Phrase

So far I have used the term "intonational phrase in Lakota" many times in this dissertation without giving an explicit definition of what it is. Here I attempt to define the intonational phrase in Lakota based on the tonal and the boundary strength characteristics discussed earlier.

The intonational phrase (IP) in Lakota constitutes a prosodic phrase that is primarily defined with tonal properties. First, the IP in Lakota must contain at least one major H* pitch accent nucleus. Second, the right edge of the IP carries a boundary tone which is realized on the last syllable of the phrase. The boundary tones encountered in the analyzed database are L%, %, and !H%; among these the L% and % are the the most frequent. A clear example of L% boundary - with subsequent pitch and declination reset - can be seen in figure 4.6, corresponding to example (61) in section 4.3.3.2. The tonal transcription of the first intonational phrase in figure 4.6 is shown below in example (65). I have marked the IP prosodic phrase in example (65) with square brackets in the Lakota line, followed by an *IP* subscript (i.e., $[\ ]_{IP}$ encloses the entire Lakota phrase).

(65) tones: (L) H* L L (L) H*L %

segments: [wičháša =ki wakhúl-iyáya-pi]$_{IP}$

gloss: man DET$_{def}$ hunt-set.out-pl

"The men went out hunting." [Speaker DBW06:N]

In addition to a boundary tone, the last syllable of the IP frequently exhibits one or more suprasegmental phonetic cues for a strong prosodic juncture. After the IP boundary tone, the pitch level and the average declination usually reset to new initial values. Refreshed F0 level and slope are generally reliable indicators of the start of a new intonational phrase. Additional phonetic cues that can optionally co-occur with the boundary tone and pitch reset are pre-boundary lengthening, post-boundary pause, and boundary glottalization in the form of creaky phonation. Example (66) contains a declarative IP with an L% boundary that is accompanied by final glottalization, as well as post-boundary pause and pitch reset. These phonetic cues to the juncture are labeled in figure 4.10. In example (66) the boundaries of the intonational phrase are again marked with the [ ]$_{IP}$ square bracket notation in the Lakota line of the transcript .

(66) [thȟa-ópi šíča ečíya-pi]$_{IP}$ [ča leháŋl ...

3.pos-wound bad$_{V-S}$ call-pl so nowadays$_{ADV}$

"They called him BadWound. So, nowadays ... " [Speaker DBW09:N]

Finally, as far as the data analysis in this study indicates, none of the post-lexical fast speech phonological reductions at word boundaries discussed in section 4.2.4 apply across an IP % boundaries.

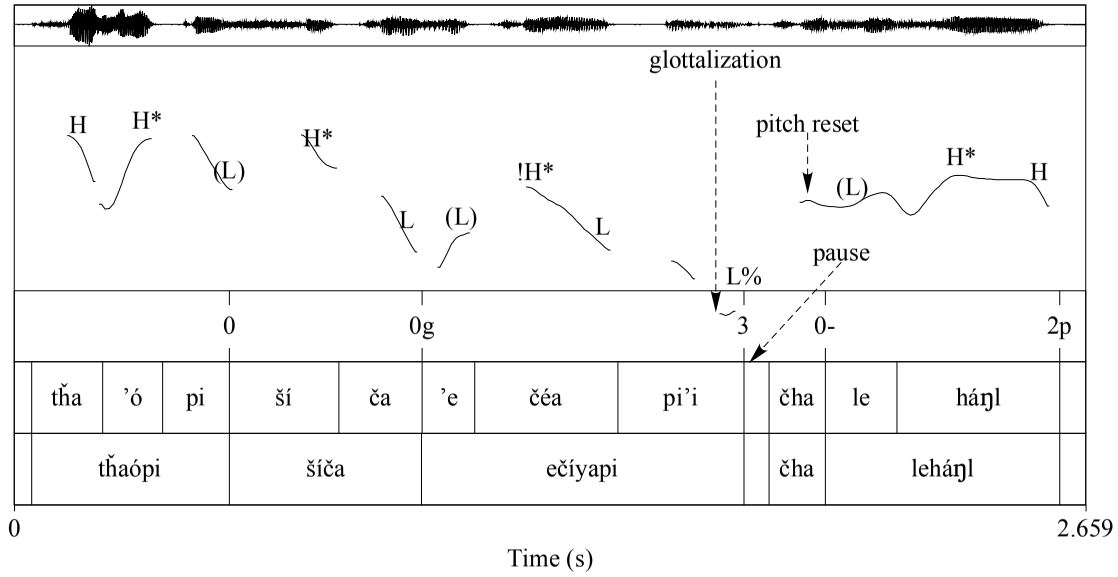


Figure 4.10: Several phonetic cues are associated with an IP boundary. L% boundary tone with glottalization, pause, and pitch reset, are all indicators of a very strong prosodic juncture. All these cues co-occur at the offset of the word *ečíyapi* in this phrase; example (66).

4.4.2 The Intermediate Phrase

In this section I provide substantial evidence from the data in favor of an intermediate phrase category in Lakota prosodic structure. The intermediate phrase defined here is smaller than the intonational phrase and, in general, larger than a single grammatical word (depending on the length of the word in context). In what follows I first define the intermediate phrase category based on several tonal observations concerning phrase accents and downstep. Then, I argue that the proposal of an intermediate phrasal category allows for a better understanding of phrase accents and the alignment charactersitics of trailing L tones in the basic LH*L pitch accents discussed in Chapter 3 (section 3.3.4.2). Finally, I consider several phonological aspects of the intermediate phrase that lend further support to its validity as a structure in Lakota prosody. What I hope to show in this section is that the recognition of an intermediate phrase constituent makes a significant contribution to the understanding of the larger organization of Lakota prosody.

4.4.2.1 Tonal Characteristics of an Intermediate Prosodic Category

Like the IP, the intermediate phrase (abbreviated with lower case "ip") is primarily characterized by tonal properties. I define the intermediate phrase in Lakota as a prosodic unit that is bounded by a phrase accent at its right edge. Recall from Chapter 3 that the three possible phrase accents in Lakota are L, !H, and LH. The place of the *ip* inside the Lakota prosodic structure is such that an IP consists of at least one *ip*. An *ip*, in turn, consists of *at least* one lexically stressed major category word which carries an (L)H*(L) pitch accent. Measurements based on three data sets, representing all three participants, indicate that *ip*s in the narrative genre typically consist of two or three words.[9]

An outstanding feature of the intermediate phrase in Lakota is that it defines the domain of application of downstep (DS). Recall from table 3.3 (page 121) that some 40 to 45% of non-initial H* peaks in declarative utterances display downstep (!H*). This statistic implies that there are many non-initial peaks that do not

[9] The exact average values are: 2.4 words/*ip* (DBW06), 2.2 words/*ip* (PRS73), and 2.1 words/*ip* (SOF73).

display downstep relative to a previous H*. Thus, downstep inside the large IP is not automatic. In the Lakota data there are both [H*L H*L]$_{-DS}$ and [H*L !H*L]$_{+DS}$ sequences of pitch accents. Figure 4.11 displays two different intonational phrases from the dataset. In the IP in panel (a) there is no downstep between the two peaks while in the IP in panel (b) there is a downstep between the two peaks.

(67) (a) iyáya-pi okíhi-pi =šni **-DS** (no downstep)
set.out-pl able-pl =neg
"They were not able to leave ... "

(b) omníčiye yuhá-pi naháŋ +**DS** (with downstep)
meeting have-pl and$_{CONJ}$
"They had a meeting, and so ... " [Speaker DBW06:N]

Strong evidence for an intermediate phrase - and, thereby, a phrase accent - analysis is provided by comparing utterances with -DS and +DS sequences that occur inside the same intonational phrase. Example (68), displayed in figure 4.12, shows a Lakota intonational phrase with four H* peaks. In this phrase the second peak does not display downstep relative to the first peak, and the third peak does not display downstep relative to the second peak either. But the fourth peak displays downstep relative to the third one. I analyze this IP as consisting of three units separated by L phrase accents. The first and second H*s are separated by a low level, shallow slope, L phrase accent over a lengthened syllable. The second and third H*s are separated by a very similar L phrase accent over a lengthened syllable, followed by a short pause.[10] By contrast, the third H* and the fourth !H* pitch accents are not separated by a phrase accent, a pause, or lengthening. The post-tonic L tone in between the the third H* and the fourth !H* shows a much steeper slope, characteristic of { H*L !H*L } or { H* L!H*L } pitch accent sequences.

[10] Recall from section 3.3.4.2 that phrase accents typically display multiple linking to two locations in the post-nuclear stretch of the utterance. The F0 track of the first L phrase accent in figure 4.12 clearly displays both immediate post-nuclear and *ip*-final linking.

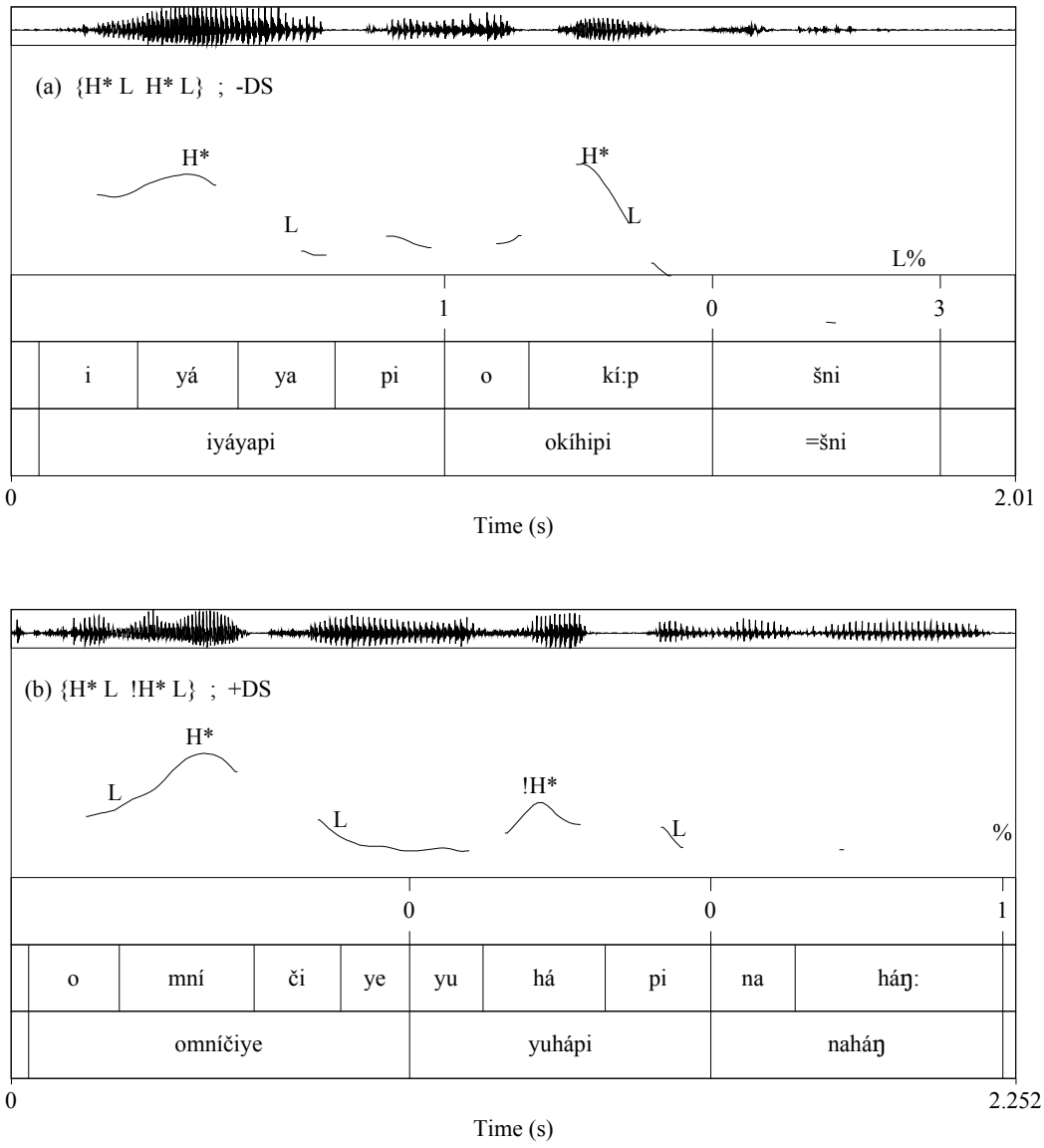


Figure 4.11: Two separate intonational phrases, each with two H* pitch accent nuclei. In the top panel (a), the two H* peaks show no downstep. In the bottom panel (b), the second H* is downstepped relative to the first. Both intonational phrases are from speaker PRS73.

(68) [ziŋtkála =waŋ tȟó ča nakúŋ waŋbláke]$_{IP}$

bird =DET$_{indef.real}$ blue DET$_{rel}$ also$_{CONJ}$ 1.sg.agt.see

"I also saw a bird that was blue." [Speaker DBW09:SC]

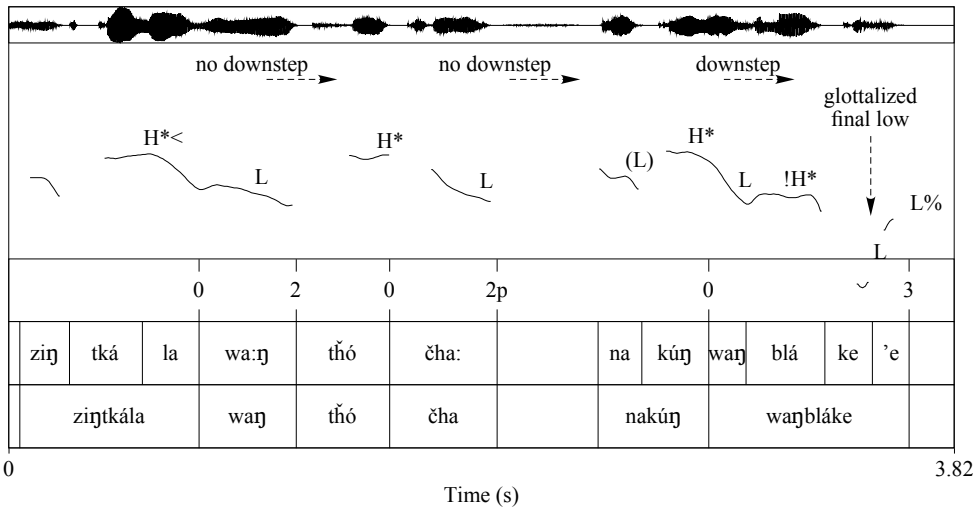


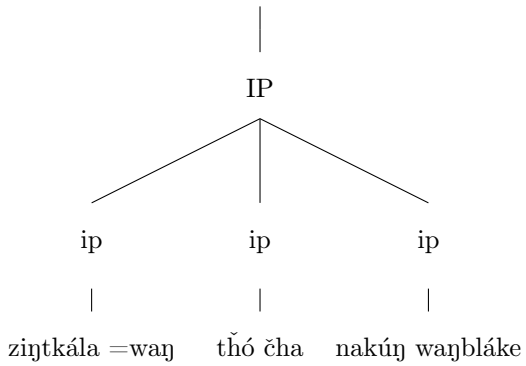
Figure 4.12: An intonational phrase with -DS and +DS sequences of words. Notice that the -DS sequences are separated by lengthening (plus pause in one case), and what appears to be an L phrase accent. The +DS sequence shows no lengthening or pause in between, and the L tone in between shows a sharp drop to a trailing L target of an H*L pitch accent. Figure corresponds to example (68).

In terms of prosodic breaks, the entire utternace in example (68) ends with a low boundary tone, accompanied by glottalization. These are marks of an IP boundary. By contrast, the -DS units that come earlier do not show final falls and glottalization, indicating that their junctures are not as strong as the IP-final juncture. In the break index tier in figure 4.12 I have labeled the breaks between the -DS units with BI=2, while the final IP-final boundary is marked with BI=3.

IPs similar to example (68) are very common in the data, for all speakers and all tasks. Given the tonal and suprasegmental cues at the boundaries of words with -DS versus boundaries of words with +DS, the simplest way to analyze this application versus non-application of downstep is in terms of a phrasal category that is smaller than the IP. Furthermore, this smaller-than-IP phrasal category can be larger than

a single word since two adjacent words in a +DS unit are analyzed as being within the bounds of the higher, but intermediate, category. In a hierarchical prosodic structure, with IP and *ip* phrasal categories, example (68) can be represented with the following metrical structure.

Diagram 6



Whenever - and for whatever morphological, syntactic, or discourse focus related reasons - major-category words are separated by an *ip* boundary, their associated H* peaks generally do not display downstep. In example (68), the noun *ziŋtkála* and its modifier-verb *tȟó* are separated due to contrastive focus on *tȟó*. The contrastive focus is coded by the presence of the article *ča*. This separation into individual *ip*s suspends the application of downstep. By contrast, whenever two adjacent major-category words are within the same *ip*, most of the time their respective H* peaks display downstep.

4.4.2.2 Alignment of Trailing Tones and Phrase Accents Revisited

In section 3.3.4.2 (page 108) I gave evidence from the data in favor of an intonational analysis that proposes three types of phrase accents in Lakota. Recall that the L phrase accent typically starts from the elbow of the trailing tone of the preceding core LH*L pitch accent and stretches over several post-tonic syllables. Thus, phonetically, the L phrase accent appears in the F0 track as a continuation of the trailing tone of the last pitch accent. I argued in Chapter 3 that the post-nuclear stretch of these phrase accents can be modeled in terms of a multiple association of the phrasal tone to the segmental tier.

More careful analysis of the F0 track in the post-nuclear region of LH*L pitch accents shows that the trailing L tones display additional degrees of variation in their phonetic realization. More specifically, in any given sequence of { (L)H*L ... H*L } pitch accents in a phrase, the trailing L tone of the first pitch accent may surface in the F0 track in at least four different ways. These are as follows.

- The intervening L tone may phonetically appear as just an elbow within the first (or second) post-tonic syllable from the first H* nucleus.
- Given the right discourse and speech rate conditions, the intervening L tone may "spread" or associate to more than one post-nuclear position. This results in two phrases: { (L)H* L... } { H*L }.
- The intervening L tone may arrive "late", appearing as a leading tone on the second H* accent. In this circumstance, the resulting phrase is { (L)H* ... L H*L }.
- If the speech rate is fast and the words are short (i.e., monosyllabic or disyllabic), then the L in between the two H* pitch accent nuclei may be undershot, giving rise to a { (L)H*.. H*L } sequence.

These observations suggest that the trailing L tone of the core LH*L pitch accent is only weakly bound to the H* nucleus that precedes it. Given different focus, speech rate, and morpho-phonological conditions, the post-nuclear trailing L tones behave in different ways. The trailing L tones, therefore, appear to be a somewhat fluid part of the full LH*L pitch accent; they can delete, move around, or reshape to display the spreading or multiple linking characteristics that is typical of phrase accents. When the trailing L tones transform into phrase accents, they block the application of downstep and create intermediate phrases in the utterance. The process of partial L detachment and multiple linking (or spreading) is displayed very clearly in the F0 track of the post-nuclear lows in figure 4.12.

If the L phrase accent is defined in terms of a multiple linking of the semi-independent tailing tone of an LH*L pitch accent, then the question remains as to how to define the !H and LH phrase accents in Lakota. One crucial observation with respect to the high phrase accents is that they are frequently associated with

grammatical words that can, under focused circumstances, carry their own H* nucleus. The grammatical words that frequently carry !H or LH phrase accents are conjunctions (such as *naháŋ*), adverbs (such as *lehάŋl*), demonstrative pronouns (such as *henά* or *lenά*), or accent bearing particles (such as *él* or *ektά*). When such accent-bearing grammatical words are in a context where they can function to delimit a prosodic unit of speech, then they become the docking site for a phrase accent. However, since these grammatical words are underlyingly stressed, they can only receive high accents.[11] The phrase accent that these words typically carry is then either !H or LH.

This argument can be extended even further to explain why the simple !H phrase accent is actually a downstepped accent. The simple high, as a phrase accent delimiting an intermediate phrase, is not the first accent in the *ip* that it is trying to delimit. The first accent in the intermediate phrase must be a preceding starred pitch accent. Since the !H phrase accent is the second (or third, or *n*th) potential high accent inside a given intermediate phrase, it is downstepped relative to the preceding H* nucleus. The !H then usually establishes a new high for the next intermediate phrase that follows. The LH phrase accent can take two forms: LH or L!H. It appears that the non-downstepped LH form is used when the speaker needs to re-reach the high level of the preceding intermediate phrase in the next upcoming intermediate phrase. I discuss this further in the next subsection.

4.4.3 The Prosodic Word

In the previous section I described the intermediate phrase in Lakota as a prosodic constituent that is smaller than the intonational phrase. That is, the larger intonational phrase can consist of one or more intermediate phrases. Both constituents are defined primarily based on the characteristics of their edge tones. The database of Lakota phrases analyzed shows that each intermediate phrase can, in turn, consist of one or more lexically stressed words. In this section I address the issue of a prosodic constituent that is smaller than the intermediate phrase. In particular, I discuss the notion of a Prosodic Word (ω) in Lakota

[11] As discussed in Chapter 3, the Lakota data used for this study does not show any evidence for L* pitch accents. All accent bearing words carry an H* nucleus in focused position.

and attempt to define it in two different ways. As I will show, for the case of Lakota, the notion of a Prosodic Word is not simple to define.

4.4.3.1 The Prosodic Word: Domain of the Dakota Stress Rule

In sections 3.2.1 and 4.2 I discussed the properties of lexical stress in Lakota and explained how the DSR (Dakota Stress Rule), its ordering relative to the lexical morphology and phonology, is able to account for most of the lexical level prominence characteristics of words. The definition of a "word" given in section 4.2 is: A word in Lakota is a unit of speech that *minimally* carries a single DSR assigned stress. The qualification allows the definition of a grammatical word to apply to complex words, such as syntactic compounds, which carry two stresses - one primary and one secondary. Although syntactic compounds carry two stresses they are still within the domain of a single morphological word in Lakota; the individual members of the compound group together prosodically in accordance with the DSR metrical rule for word tree construction (see Shaw 1985 for details).

Since the DSR applies to all major category words in Lakota, and since larger intonational and intermediate phrases contain at least one major category word, this suggests that one way of defining a prosodic unit smaller than the intermediate phrase is to base the definition on the DSR itself.

Prosodic Word 1 : A unit that is coextensive with the domain of application of the Dakota Stress Rule.

Based on this definition, the minimal sequence of basic units that can function together as a Prosodic Word is a stem plus its bound morphology. The bound morphology in Lakota includes prefixes and some suffixes that appear as clearly attached to the root. In the set of suffixes here I include the plural marker *-pi* which has traditionally been called an enclitic. By definition, all "enclitics" that are ordered before *-pi* are within the domain of the Prosodic Word as well. The enclitics that are ordered after *-pi* are more problematic for the definition of the Prosodic Word. I return to the issue of post-*pi* enclitics in section 4.5.

As far as Lakota compound words are concerned, the definition above implies that lexical compounds should be considered as a single Prosodic Word while syntactic compounds should be considered as two Prosodic Words. For example, under this analysis, the syntactic noun-verb compound *šúŋkawakȟàŋ* ("horse") consists of two Prosodic Words. The first prosodic word is ω_1=šúŋka ("dog") and the second prosodic word is ω_2=wakȟáŋ ("it is sacred").[12] Based on the definition of word given above, the serialized compounds (discussed in section 3.2.1, page 64) generally consist of two separate prosodic words as well.

4.4.3.2 The Accentual Prosodic Word

Since the intonational and intermediate phrases are defined primarily based on tonal properties, it is logical to ask if there are certain tonal characteristics which can be used to define a Lakota Prosodic Word as well. Since an intermediate phrase in Lakota consists of at least one major word, one way of informally defining a Prosodic Word is to say that it is the minimal sequence of segments that can be produced as an intermediate phrase. Once again, generally, such a minimal sequence in Lakota consists of a stem and its bound morphology (including the inner layer, attached, enclitics). Since the intermediate phrase carries at least one major category word, and since major category words in utterances usually carry an H* pitch accent nucleus (as identified in Chapter 3), this would allow for a tone-based definition of the Prosodic Word.

Prosodic Word 2 : A unit of speech that carries one H* pitch accent nucleus.

Under this tone-based definition of Prosodic Word, syntactic compounds generally constitute two prosodic words, with each member of the compound carrying a major pitch-accent (H* or !H*). With respect to the unstressed particles and enclitics, the tone-based definition arrives at exactly the same conclusions as the DSR-based definition. Namely, these dependent elements generally do not carry an H* nucleus and so are not prosodic words by themselves.

[12] It seems appropriate and important to mention that for many of the contemporary bilingual speakers this traditionally syntactic compound form may be in the process of re-analysis into a single word. Many younger speakers only produce *šúŋkakȟaŋ*, in which the formerly inter-prosodic-word [awa] sequence has been reduced and replaced by a simple, unstressed, low vowel [a].

There is a good match between the tonal and DSR definitions for Prosodic Word. However, there are some contexts in which the tone-based definition and the DSR-based definition do not agree. One such context is the phenomenon of final de-accenting, discussed in section 3.3.3.9 (page 100). Phrase-final de-accented items, usually verbs or conjunctions, form an intermediate phrase with a preceding major category word, usually a noun or an adverb. The preceding noun or adverb carries the main, and only, H* pitch nucleus in these contexts. Example (69), from the scripted conversations, is an OV intonational phrase that displays final de-accenting. Note that it is the entire intermediate phrase (noun plus verb in this case) that carries an H* nucleus.

(69) [iyéčhiŋkiŋyaŋke =waŋ waŋbláke]$_{IP}$

car$_{complex.noun}$ =DET$_{indef.real}$ 1.sg.agt-see

"I saw a car." [Speaker DBW09:SC]

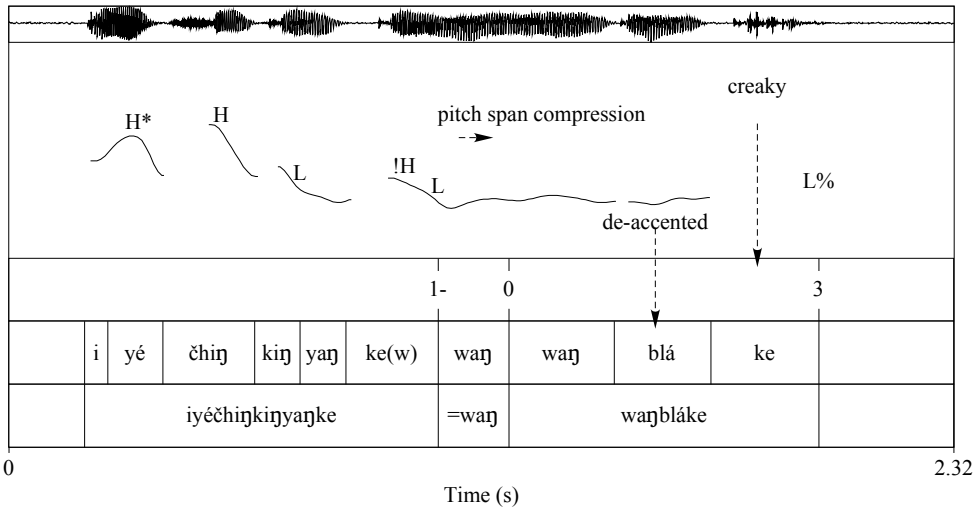


Figure 4.13: De-accented phrase-final verb in example (69).

Under the DSR based definition of Prosodic Word, the verb in example (69) would still be considered as its own prosodic word since it carries stress, despite being de-accented. Table 4.4 shows a tabulation of

the different kinds and total number of H*s, as well as the total number of stressed syllables, N(σ*), for each speaker in the narrative tasks. Although there is a general agreement between the total number of accented nuclei and stressed syllables, for every speaker there is a percentage of lexically stressed syllables that are unaccented. This percentage is indicated in the last column of the table.

Narratives	N(H*)	N(!H*)	N(Ĥ*)	N(H*<)	*Total H**	N(σ*)	% Unaccented
DBW06	59	36	10	2	107	121	11.6%
DBW09	62	26	3	3	94	110	14.6%
SOF73	37	28	6	0	71	75	5.3%
PRS73	43	13	4	0	60	76	21.1%

Table 4.4: Number of different H* types and the total number of lexically stressed syllables N(σ*) in declarative intonational phrases. Data is tabulated according to speaker and task. Mismatches in number of H*s and σ*s usually indicate de-accented contexts.

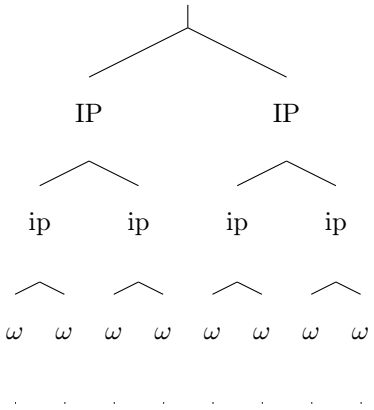
For speakers PRS and DBW, the majority of the cases of de-accenting occur on the post-verbal conjunctions such as *naháŋ* ("and"), the phrase-final demonstrative pronoun *hená* ("them"), or adverbs such as *lehán̓l* ("these days"). Many of these are similar to the example of de-accenting discussed in Chapter 3, figure 3.23 (page 103). The de-accented conjunctions and adverbs often carry an L, or a very compressed !H, phrase accent. Speaker SOF uses de-accenting less frequently, as already discussed.

4.4.3.3 Discussion of the Prosodic Word

Whichever definition one adopts, it appears that some notion of a Prosodic Word constituent is useful for the analysis of Lakota phrasal structures that are large enough to constitute a domain for DSR or H* assignment. The Prosodic Words can group together to form larger intermediate and intonational phrases. If the Prosodic Word is not too lengthy and the speech rate is not too slow,[13] Lakota phrases show the expected prosodic layering hierarchy displayed in the metrical diagram below.

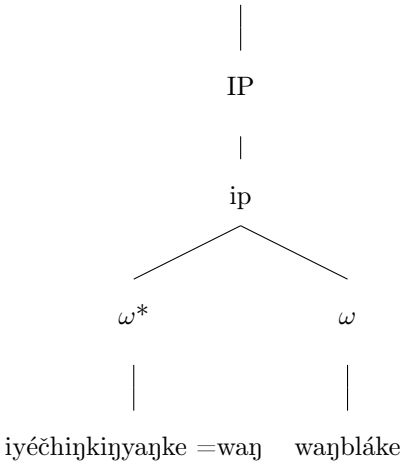
[13] I use these terms "too lengthy" and "too slow" rather loosely here. I evaluate these notions more quantitatively in section 4.4.4.

Diagram 7



If we accept the DSR definition for Prosodic Word, example (69) can be represented by the following prosodic structure. The [*] on ω* indicates that this Prosodic Word is metrically stronger; it is the word which receives the main pitch accent nucleus (for whatever discourse pragmatic reasons).[14]

Diagram 8



4.4.4 Effect of Speech Rate on Phrasing

In the last section I posited a hierarchically arranged prosodic structure for Lakota utterances which has, at least, the following three-layered structure.

$$[\ \{(\ \ )_\omega(\ \ )_\omega\}_{ip}\ \{(\ \ )_\omega(\ \ )_\omega\}_{ip}\ ]_{IP}$$

[14] Note that in example (69) the object noun has the non-prototypical H*HL pitch accent, discussed in chapter 3, page 92. However, the specific type of pitch accent does not effect the strong-weak relation shown here. All that matters is that the object NP is the item that receives the only major pitch accent.

Given this prosodic structure, one basic question to ask is why the words in an utterance, in a given context, are arranged this way. More specifically, what factors influence whether adjacent prosodic words in speech are grouped into a single *ip* or separated into different *ip*s? Most likely many linguistic factors - such as the rate of speech, moprho-phonological structure of the segmental material, presence of complex constructions, and elements of focus and pragmatic information - simultaneously play a role. I do not attempt to address all the aspects of this complex problem. Rather, in this section, I briefly consider one factor that appears to have some influence on the phrasing of words. The effect I examine is that of speech rate. The analysis I present here is based on intonational phrases from the narrative data, from all three speakers. In the next section (4.5) I will examine another factor - namely, morpho-phonological length and the presence of enclitics - that also plays a role in phrasing of adjacent words in Lakota.

One of the main issues in trying to address the influence of speech rate on phonological phrasing involves defining measurements of speech rate and phrasing. There are different ways to arrive at definitions, partly dependent on what the larger question is that is being asked. Here I simply want to examine a general overall trend in the data to see whether speech rate influences phrasing or not.

The methodology I have used for the measurements is as follows. First, I chose a subset of the data to make the measurements on. The subset I chose for this analysis is made up of declarative IPs in three of the narratives (PRS73, SOF73, DBW06).[15] For each IP I need two measurements. One measurement should be some equivalent to an average rate of speech in the IP. The other measurement should be a rough indicator of how "broken up" adjacent words are in the IP. The definitions I use for each measurement are the following.

Measurement 1: Speech Rate

I define the localized speech rate of a single IP token from a narrative simply as the *average syllable duration*=τ_σ in that IP.[16] This value is calculated by measuring the total duration of the IP (ignoring very long pauses) and dividing the time measurement by the total number of uttered syllables in the IP.

[15] See section 3.3.2, page 76, for details of how the database of declarative IPs was constructed from the original raw dataset.
[16] The measure of syllables per second would also be equivalent.

Measurement 2: Word Junctures

Suppose that an IP contains N_w individual words, with the right-edge boundary of each word coded with a break index value. The mean prosodic distance between adjacent words in the IP is then calculated by computing the *average total break index value* for that IP.

$$< BI_{tot} >= \frac{1}{N_w} \sum_{j=1}^{N_w} BI_j$$

In this equation, BI_j is the coded break index value between adjacent words j and $j+1$ in a given IP. For the last word in the IP, $BI_{j=N_w}$ equals the break index value at the right edge of the intonational phrase (i.e., the break index value at the % boundary tone). Recall from Chapter 2 that the coding scheme for LaToBI uses the set of break values {-1, 0-, 0, 1-, 1, 2, 3}. In order to convert this to proper numbers for summation I transform the [0-] and [1-] values into real numbers. For the purpose of calculation, the break index values are mapped to {-1, -0.5, 0, 0.5, 1, 2, 3}. The average total break index value for an IP provides an *approximate* measure of the degree of "breakage" between the words in the IP. The way to make sense of this is as follows. An IP containing several *ip*s will have more BI=1 or BI=2 juncture values. On average, the summed BI for this IP will be large. By contrast, an IP with several word boundary phonological reductions will contain many negative junctures (i.e., BI = -1 or -0.5) and, therefore, a lower $< BI_{tot} >$ value .

Figure 4.14 shows plots of the measurements of BI_{tot} versus τ_σ for IPs in each of the three narratives in the declarative data subset. Note that as τ_σ increases the average speech rate decreases. The plots in this figure show a general trend of higher $< BI_{tot} >$ values for slower speech rates. The numbers of IPs and *ip*s for each dataset is indicated in the figure as well. Several interesting patterns should be noted here. Speaker PRS did not vary his speech rate by large amounts. For the SOF data, the points appear more "scattered" and the linear correlation is more difficult to observe. Speaker DBW displays the largest range of speech rates, as well as the best correlation for the trend of increased $< BI_{tot} >$ for slower speech rates.

One of the factors that complicates the measurement of the average break index value concerns the status of the less bound post-verbal enclitics, post-nominal articles, and free particles. These items show a

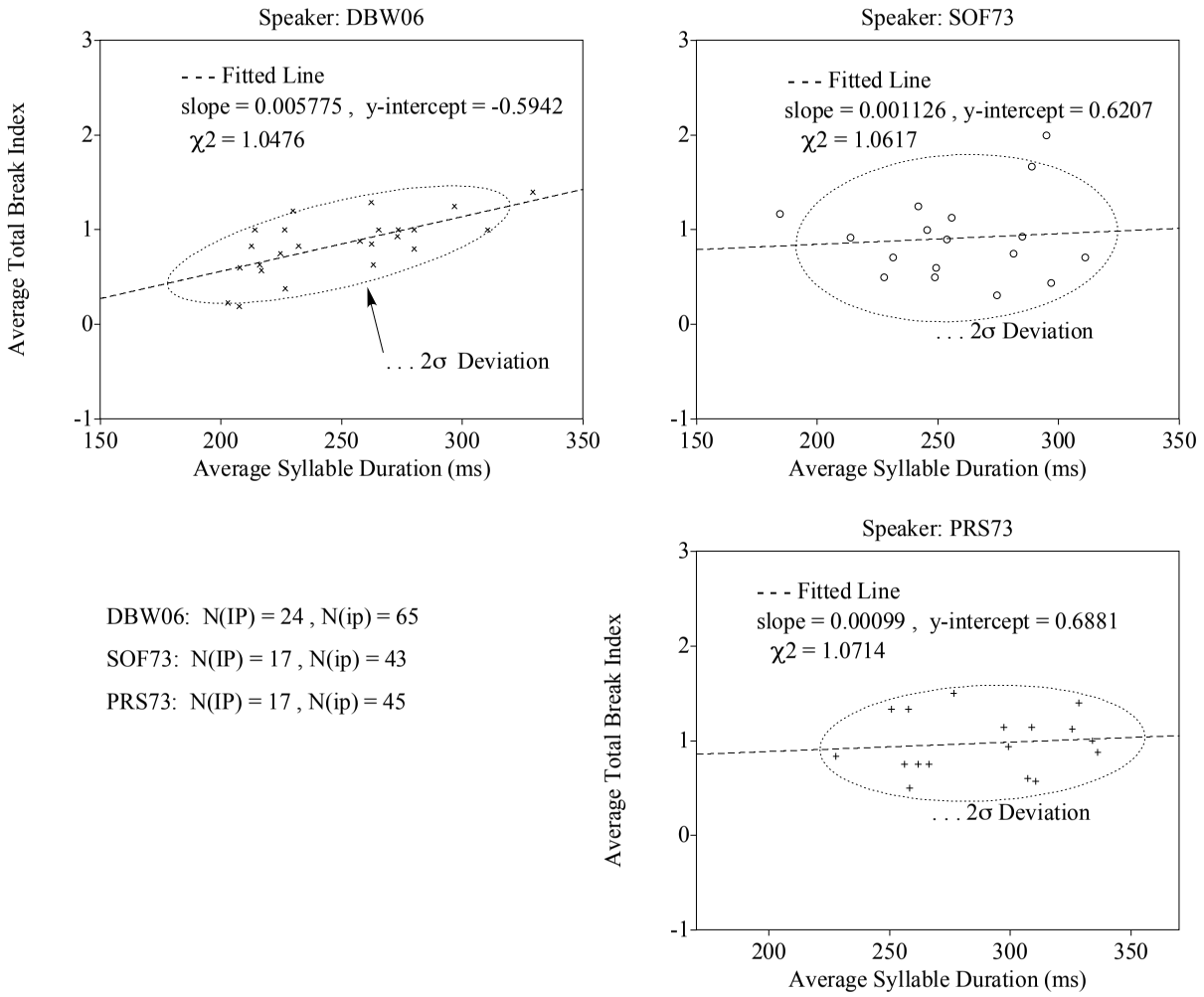


Figure 4.14: Plots of $< BI_{tot} >$ versus τ_σ, for speakers DBW, SOF, and PRS, performing the narrative tasks. Each plot point in the graphs indicates the measurements for one IP token in the given narrative. The general trends indicate that the mean prosodic distance between adjacent words increases as the average syllable duration increases (i.e., as the speech rate becomes slower). The DBW06 data subset shows the best linear fit, as well as the best rising-trend correlation.

tremendous amount of variation in terms of how glued they sound, perceptually, relative to their adjacent major-category words. The boundaries between the nouns and articles display the most cases of uncertainty in the break index coding. I now turn to the prosodic analysis of some of these loosely bound items.

4.5 Prosodic Phrasing with Enclitics

The discussion and examples in section 4.4 indicate that intermediate phrases in Lakota typically consist of, at most, a few phonological words. For a language like Lakota, it is interesting to consider how the phrase final enclitics (shown in table 4.1, page 152) and other various and assorted function words and particles behave with respect the proposed prosodic organization. In the section on Prosodic Words (section 4.4.3) I deliberately avoided the enclitics and particles. In this section I attempt to incorporate them into the prosodic analysis.

Recall that the Lakota enclitics pose some problems for the definition of a "word" in the language (see section 4.2.3). Earlier I mentioned that in the metrical model of Lakota lexical phonology all enclitics are treated as an outer layer of grammatical word formation. However, I also pointed out that in the LaToBI transcriptions of word boundaries I have treated the post-*pi* enclitics as different from *-pi*. In this section I attempt to provide a clearer picture of the internal organization of the enclitics. As I will show, the results from my small experimental study justify a split treatment of the Lakota enclitics from a tonal and supra-segmental perspective. The analysis also sheds some light on the prosodic phrasing of post-verbal enclitics and morpho-phonologically long words. Several ambiguities, however, remain unresolved. I discuss these at some length and provide directions for future research on the topic of enclitic phrasing.

4.5.1 The Enclitic Data Set and Experiment

The analysis of enclitics provided here is based primarily on phrases from two semi-spontaneous, conversational tasks performed by speaker DBW. These tasks, discussed in section 2.3.1 (page 31), were

primarily designed for eliciting constructions with several post-verbal enclitics and longer morphological structures. Below I describe the different parts of the experimental task and illustrate the kinds of sentences that resulted from each.

Sub-Task 1: The speaker was asked to participate in a conversational exchange regarding a scripted scenario. The scene imagined is the following. There is going to be a dance this evening and two people are sitting down and talking about who is going dance, who is not going to dance, who usually dances, and various exchanges like these. The task was, of course, purposefully designed to obtain sentences involving different kinds of modalities. These modalities are produced spontaneously and semi-naturally because of the scripted design behind the elicitation. An example of a sentence produced in the middle part of this scripted conversational exchange is shown in (70). This particular sentence contains *-pi* and three post-*pi* enclitics (marked by the prefixed symbol "=") in phrase final position.

(70) wakáŋpi =ki lená wačhí-pi =kte =šni =kéya-pi

elders DET$_{def}$ these$_{DEM}$ dance-pl =irr =neg =quot$_{say-pl}$

"They say that these elders are not going to dance." [Speaker DBW09:SC]

There were a total of nine utterances produced in this exchange. These sentences varied in length. Furthermore, they included different numbers of post-verbal enclitics. Some of the utterances contain just one enclitic, while others contain up to four enclitics from different enclitic position classes. The enclitics produced in this task, along with their respective position classes, are shown in table 4.5.

1	2	3	4	5	6	7	8	9	10	11	12
	-pi			ktA	šni	s'a		kéyapi	kštó		he
	pl			irr	neg	hab		quot	decl.emph		interr

Table 4.5: Lakota enclitics produced in Task 1, scripted conversation, by speaker DBW. The tabulation shows corresponding position class number and modality gloss for each enclitic. A maximum of four phrase-final enclitics were produced with a verb in the same IP.

Four of the utterances in the task were produced with self-repair cutoffs, followed by short pauses. Two of the cutoffs were in phrase-medial position. For these, only the material produced after the cutoff is analyzed. The other two cases of self-repair were initiated in enclitic-medial position; I discuss these in my analysis.

Sub-Task 2: This task was similar to the first one in that a scripted conversation was designed with an imagined scenario in mind. The scene imagined in task two is that the speaker had gone out for a walk in the country the same morning and that she saw various things. In the exchange she talks about a few of the things she saw and what happened at the end of her walk. The sentences in this exchange were designed with a particular type of structure in mind. The structure elicited included phrases in which lexically stressed syllables in IP-medial position were interspersed with different numbers of lexically unstressed syllables in adjacent words. More specifically, adjacent words with second syllable stress but with different morpho-phonological lengths were produced in this task. The data with these types of structures includes sentences like the one shown in example (71).

(71) [waŋblí =waŋ waŋbláke na]$_{ip}$ [tȟašíyagmuŋka waŋbláke na]$_{ip}$ ...

eagle DET$_{indef.real}$ 1.sg.agt.see and$_{CONJ}$ meadowlark 1sg.agt.see and$_{CONJ}$

"I saw an eagle, and I saw a meadowlark, and ... " [Speaker DBW09:SC]

In this task, the speaker generally described things by linking several intermediate phrases together with conjunctions. I have indicated the *ip* phrasing in the Lakota line of the transcription in (71) with square brackets [ ]$_{ip}$. Note that the first *ip* has two stressed syllables separated by two unstressed syllables, while the second *ip* has two stressed syllables separated by four unstressed syllables. The sentences in the task resulted in the production of word sequences with a maximum of six intervening unstressed syllables.

Sub-Task 3: This third task of scripted conversational exchange was designed to spontaneously elicit the production of phrases that contain clitic-like articles and demonstratives in post-nominal position. The pre-planned sentences included the articles *ki* (definite), *waŋ* (indefinite, real, singular), and *eyá* (indefinite,

real, plural). The only post-nominal demonstrative for which enough sentences were obtained in this task is *lená* ("these"). Example (72) shows a sentence with two post-nominal items, *ki* and *lená*. Note that the sentences in this sub-task also include some post-verbal enclitics.

(72) hokšíla =ki lená wačhí-pi =s'a
boy =DET$_{def}$ these dance-pl =hab
"These boys usually dance." [Speaker DBW09:SC]

I analyzed the data from these scripted conversational exchanges in the same way that I have done for the rest of the database. The pitch analysis was carried out in Praat and the data was coded for the maximum eight LaToBI tiers discussed in Chapter 2. In the next section I discuss several of the outcomes from the analysis.

4.5.2 Enclitic Task Results

The tonal analysis of the small subset of data with various types and number of post-verbal enclitics shows several interesting results. In this section I summarize the outcomes as follows. First, I discuss the characteristic tonal signatures of the post-*pi* enclitics shown in table 4.5, when these occur individually as the only final post-*pi* enclitic. Then, I discuss interesting aspects of these post-*pi* enclitics when several of them appear together in a sequence, in IP-final position.

4.5.2.1 Individual Tonal Properties of the Post-*pi* Enclitics

The first observation concerns the unstressed post-*pi* enclitic *ktA*. This enclitic occurs very frequently in the data. It functions as the marker of irrealis modality and occurs in verbal enclitic position 4, as shown earlier in table 4.5. Based on the dataset examined here, it appears that *ktA* generally carries a final L

phase accent or an L% IP boundary tone whenever it is the only, and last (IP-final), enclitic in the phrase. Example (73) and figure 4.15 show an IP with only the =*ktA* enclitic occurring in post-*pi* position. Note the extreme low tone on the final syllable of the phrase.

(73) hokšíla =ki lená wačhí-pi =kte
boy =DET$_{def}$ these dance-pl =irr
"These boys will dance." [Speaker DBW09:SC]

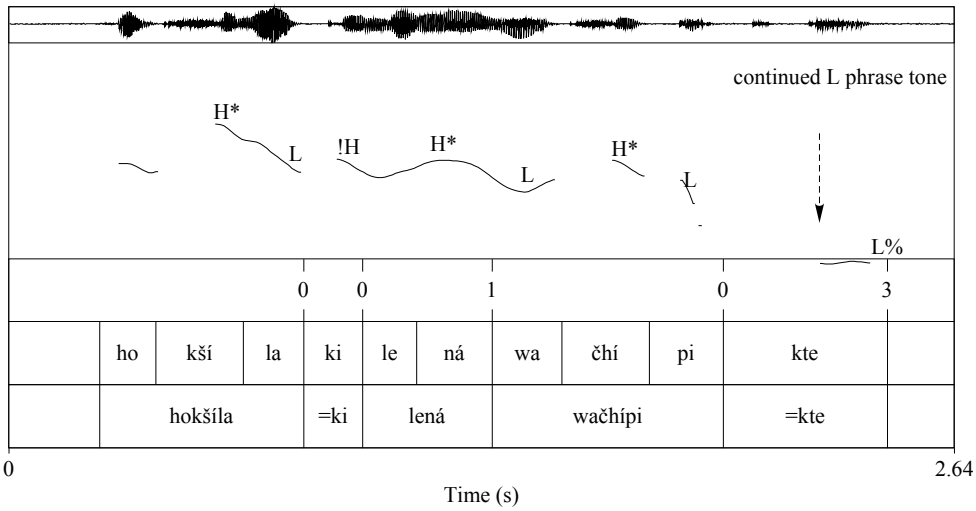


Figure 4.15: Low phrase tone on the final single enclitic *ktA* in near post-*pi* position; example (73).

The second observation concerns the following post-*pi* enclitics, *šni* (position 5) and *s'a* (position 6), when they occur in IP-final position. These enclitics show a variable tonal realization when they are the only post-*pi* enclitic in the phrase. Sometimes they carry an L phrase accent to the L% boundary tone - similar to *ktA* - but at other times they carry a slight pitch bump before a final drop to the L% boundary. I analyze these short suspensions of drop, or slight rises before a drop, as !H phrase accents on these enclitics. Example (74) shows a token of the enclitic *šni* with a final suspended fall. Notice that this pattern is similar to the !H phrase accent carried by the interrogative enclitic *he*, discussed in Chapter 3, section 3.5.3.

(74) hokšíla =ki nakúŋ wačhí-pi =šni

boy =DET$_{def}$ also dance-pl =neg

"Moreover, the boys will not dance." [Speaker DBW09:SC]

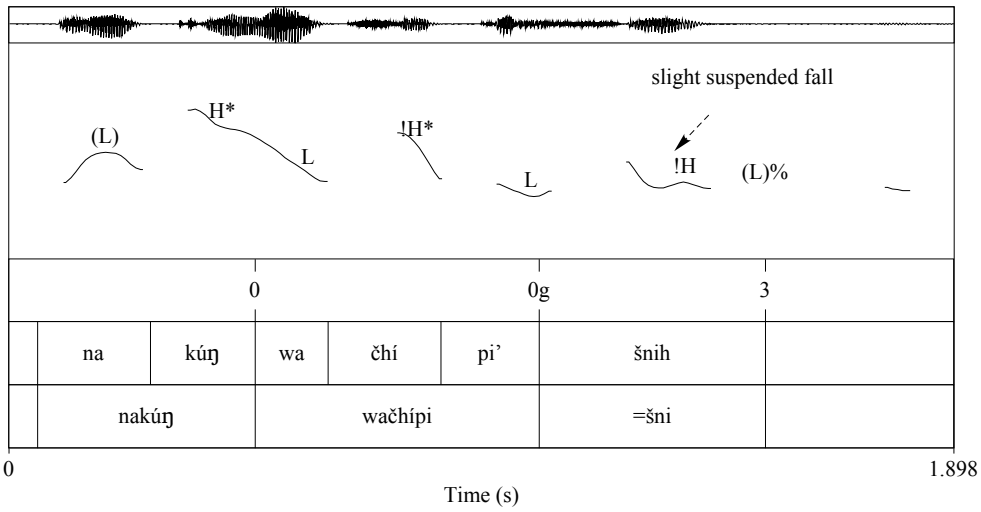


Figure 4.16: !H phrase accent on post-*pi* IP final enclitic *šni*; example (74).

The third observation concerns the outer layer, lexically stressed, enclitics such as *kéyapi* (quotative) and *kštó* (emphatic declarative). These enclitics are weakly stressed, but still usually carry a clear final !H* pitch accent peak. An occurrence of the enclitic *kštó* in phrase final position is shown in example (75), with corresponding pitch track displayed in figure 4.17. Note the presence of a compressed pitch peak on the last syllable of the phrase, right before the drop to the boundary tone. Note also that the final L% boundary drop in this example appears to be undershot, probably as a result of !H* and L% crowding together within the temporal bounds of the last syllable. In the case of *kštó*, the IP-final tonal crowding sometimes causes the !H*+L% sequence to phonetically surface simply as a !H% final boundary tone.

(75) wičhíŋčala =ki wačhí-pi =kštó

girl =DET$_{def}$ dance-pl =decl.emph

"The girls dance." [Speaker DBW09:SC]

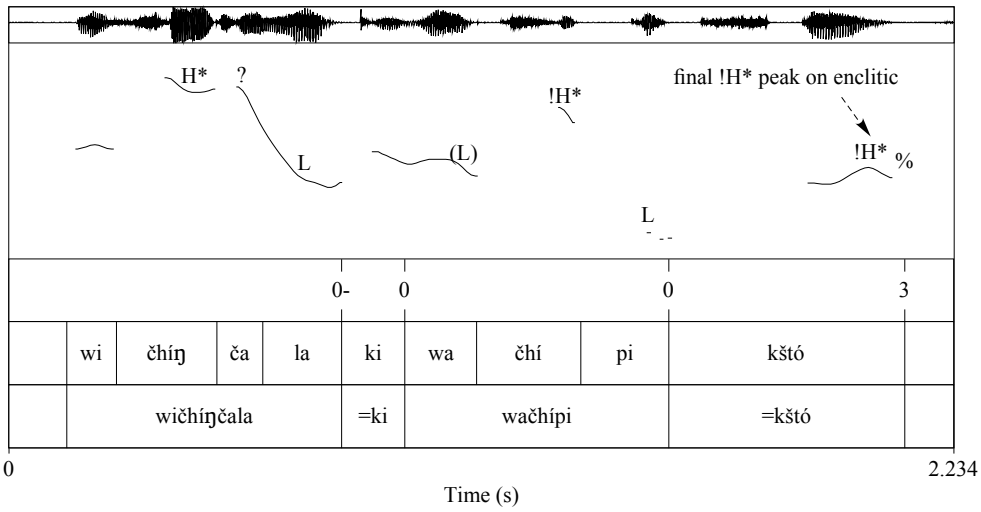


Figure 4.17: !H* pitch accent on post-*pi* enclitic *kštó*; example (75).

4.5.2.2 Tonal Properties of Post-*pi* Enclitics Together

A more interesting tonal behavior of the post-verbal, post-*pi* enclitics is revealed when several of these appear together in IP-final position. The data analysis shows that in such contexts the various post-*pi* enclitics tonally group together into a phrase accent, followed by (post-nuclear) H* pitch accents *if* lexically stressed, accent bearing, enclitics are present.

Which phrase accent the post-*pi* enclitics carry seems to partly depend on the makeup of the entire set of enclitics in the utterance. Example (76) shows an interrogative clause from the scripted conversations which contains three post-*pi*, unstressed, enclitics. The enclitics used in example (76) are *ktA* (irrealis, position 4), *šni* (negation, position 5) and *he* (interrogative, position 12). In the tonal contour in figure 4.18

it appears that the suffix/enclitic *-pi* ends in an L tone. The pitch then steps up to a relatively flat, suspended, low-mid level that spans the entire set of three post-*pi* enclitics. This span of suspended flat tone is similar to the !H phrase accent discussed in Chapter 3 (page 134). The !H phrase accent is followed by a slight drop which corresponds to the IP-final L% boundary tone.

(76) ... lená wačhí-pi =kte =šni =he

... these$_{DEM}$ dance-pl =irr =neg =interr

"... aren't these (people) going to dance tonight?" [Speaker DBW09:SC]

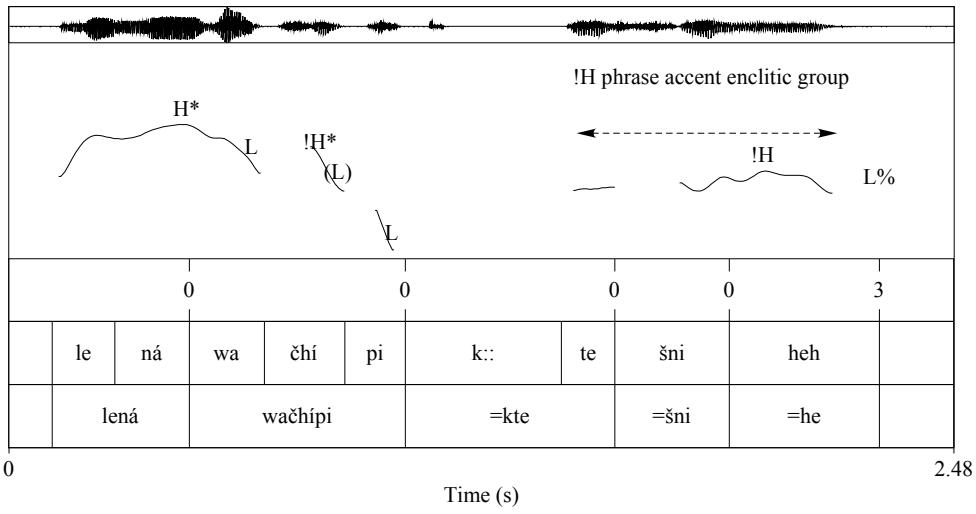


Figure 4.18: !H phrase accent on a sequence of three post-*pi* enclitics; example (76).

When a group of post-*pi* enclitics contains a lexically stressed outer layer enclitic toward the end of the IP, in all cases an L!H phrase accent spans the inner enclitics. This phrase accent is followed by an H* or H*L pitch accent on the stressed final enclitic, which is then followed by a drop to an L% boundary tone. Example (77) shows a sentence that contains three IP-final enclitics. The last enclitic in the set is a stressed verb form, *kéyapi* ("they say", quotative, position 9).[17] Accompanying figure 4.19 displays the

[17] Many of the stressed enclitics in Lakota are traceable to verbs. In this case the verb is *kéyA* (say), inflected for 3rd person plural. As an enclitic it is often shortened to [ké:].

LaToBI transcript and F0 contour.[18] Note that the L!H phrase accent spans the inner enclitics *kte* and *šni*.

(77) wakáŋpi =ki lená wačhí-pi =kte =šni =kéyapi

elders =DET$_{def}$ these$_{DEM}$ dance-pl =irr =neg =quot

"They say these elders aren't going to dance." [Speaker DBW09:SC]

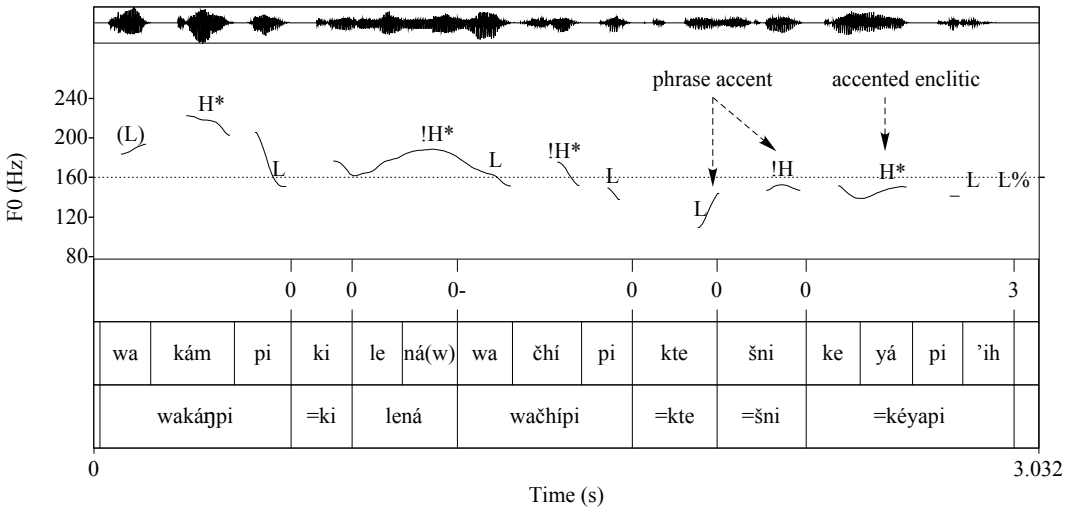


Figure 4.19: A sequence of post-*pi* enclitics. An L!H phrase accent spans the inner enclitics and is followed by a final H* pitch accent on the outer stressed enclitic; example (77).

One comment concerning example (77) seems relevant here. The first post-*pi* enclitic, *kte*, appears to carry the low part of the L!H phrase accent. In example (76) earlier, *kte* is not low; it is spanned by the !H phrase accent. This observation is another indication that when several post-*pi* enclitics are present, the phrase accent (whether !H or L!H) spans a set of the post-*pi* enclitics. The phrase accent generally starts at the latest on *ktA* and continues over to the outer, stressed, enclitics.

[18] The enclitic *kéyapi*, "they say" or "it is said", carries first syllable lexical stress. At least in the speech of DBW, however, this enclitic shows a variable stress; sometimes it is pronounced with the expected first syllable stress, while at other times it is pronounced as *keyápi* (i.e., second syllable stress). A frequently occurring conjunction, *yuŋkȟáŋ*, "and so", also displays variable lexical stress placement. In example (77), *kéyapi* is actually pronounced with *second* syllable stress. I have transcribed the expected, dictionary-entry, first syllable lexical stress in the Lakota line in example (77). The actual stress placement in this token (i.e., on second syllable) is indicated in the phonetic syllable tier of the LaToBI transcript that accompanies the F0 contour in figure 4.19. I have attempted to follow this convention throughout the entire document.

So far I have not discussed the tonal status of *-pi* itself, relative to what comes before and after. Examination of the phrases from the scripted tasks shows that in every phrase where *-pi* is followed by an enclitic, it itself carries a low pitch target. In most of the utterances produced in this task, the slope of the pitch-drop on *-pi* is fast enough, and the target L is low enough, that *-pi* usually sounds somewhat glottalized (i.e., *-pi* surfaces phonetically as [pi']). The sharp pitch drop on *-pi* is very clear in the F0 tracks in figures 4.17 and 4.18. Speaker DBW exhibits this sharp pitch drop on *-pi* in many of the cases where the suffix/enclitic is in IP-medial position as well, where it functions either as a nominalizer or as part of an adverbial clause. However, in many of the clauses produced in this task, *-pi* is also the immediate post-tonic syllable on the main verb. It could be that this sharp pitch drop is simply an attempt by the speaker to reach the L trailing tone target of an H*L pitch accent on the verb in a very short space of time. At this point I do not have a conclusive analysis of the sharp F0 drop on *-pi*.

4.5.3 The Enclitic Phrase in Lakota

Based on the evidence presented in section 4.5.2 I propose a prosodic structure for Lakota enclitics as follows. There are at least three classes of enclitics that span the entire twelve or so post-verbal positions. The three classes are distinguished by segmental, suprasegmental, and direction of attachment characteristics. I define the three prosodic enclitic classes as follows.

- Class 1 - Inner Enclitic System: The enclitics in this class minimally include *-pi* (pl, position 2), *-la* (dim, position 3), and possibly also *-kA* (att, position 4).[19] These enclitics frequently display complete attachment to the head verb, similar to suffixes. Furthermore, in immediate post-tonic position they carry the trailing L tone of the H*L core pitch accent that is associated with the stressed syllable of the verb. In IP final position these enclitics typically do not carry a !H phrase accent. In terms of duration, they often constitute short, slightly reduced, syllables. Enclitic *-pi*

[19] There is one enclitic that comes before *-pi*. This enclitic is *-haŋ*, used to designate continuative aspect. Most likely *-haŋ* also belongs prosodically to Class 1. However, the dataset used for this study does not contain enough tokens of *-haŋ* to allow for a definitive analysis of its prosodic status.

shows reduction to {/p/, /b/, /m/}, closing the V-final syllable of the head verb in the process. Enclitic *-kA* exhibits /k/ to /č/ palatalization when preceded by /i/ or /e/. This class of enclitics does not carry lexical stress.

- Class 2 - Variable Enclitics: The enclitics in this class include *ktA* (irr, position 5), *šni* (neg, position 6), and *s'a* (hab, position 7). These enclitics show variable attachment to items in their neighborhood. Sometimes they prosodically attach to the left and sometimes to the right. When they attach to the left they act tonally like the Inner Enclitic System in that they carry an L phrase accent. However, if they are the last enclitic in the IP they may carry either an L phrase accent or a !H phrase accent. When there are other enclitics to their right, the variable enclitics gravitate prosodically to these outer enclitics. Under such circumstances they carry a !H or L!H phrase accent, along with some of the outer enclitics. The variable enclitics do not reduce, but they do not carry lexical stress either.

- Class 3 - Outer Enclitic System: The outer enclitic system is rather large. It probably starts at position 8 and encompasses the remaining enclitics. Class 3 is best defined based on tonal grounds. All the enclitics in the outer system typically carry a !H tone. In addition, the enclitics that have lexical stress realize this !H as a !H* core, but secondary, pitch accent.[20] The stressed Class 3 enclitics, when present, also provide a node that gravitates and prosodically attaches the preceding Class 2 enclitics to it.

In what follows I provide several other pieces of evidence from the data that give more support to the proposed structure of the Enclitic Phrase. In the final subsection I briefly discuss some of the complications of the analysis that need further investigation.

[20] The pitch accent carried by these enclitics is prosodically somewhat similar, but not directly parallel, to post-nuclear peaks discussed in the context of European languages (Ladd 2009:284). These secondary pitch accents are usually not the main accent in the phrase, but are obligatory when the stressed enclitic is present. The presence of a stressed syllable in the enclitic set provides a docking site for the !H phrase accent.

4.5.3.1 Evidence from Self-Repair on Enclitics

One type of evidence that gives strong support to the analysis of a boundary between Class 1 and Class 2 enclitics - as well as giving support to the idea of gravitation between Class 2 and Class 3 enclitics - concerns self-repair with recycling inside enclitic phrases. As mentioned earlier, the scripted conversation tasks resulted in at least two cases of clear cutoff inside the enclitic group. Considering the entire data set for this study, there are several more cases of these enclitic cutoffs to examine.

Consider the phrase shown in example (78). In this example the speaker first produces the enclitic *ktA* in the surface form *kta*, after the plural marker *-pi*. There is an error however. The last enclitic to come, *s'eléyeča*, grammatically requires that the preceding *ktA* surface as *kte* instead.[21] The speaker stops the utterance at the offset of *kta*, makes a pause, and repairs and recycles *ktA* as *kte*. The two crucial observations in figure 4.20 are the following. First, when the speaker cuts off her speech at the offset of *kta* she only goes back to the beginning of the enclitic *ktA*. She does not return to the beginning of *-pi* or the beginning of the verb. Second, the repaired form *kte* is produced with the expected (although slightly up-stepped) H phrase accent that spans it and the following stressed enclitic.

(78) na nakúŋ wičháša =ki wačhí-pi =kta . =kte =s'eléyeča
and also man =DET$_{def}$ dance-pl =irr . =irr =it seems
"And also, it seems that the men will dance too." [Speaker DBW09:SC]

[21] This is the process of final vowel ablaut in Lakota. Lexical items and enclitics that have a final ablaut vowel have a capital *A* transcription as their final, partially underspecified, segment.

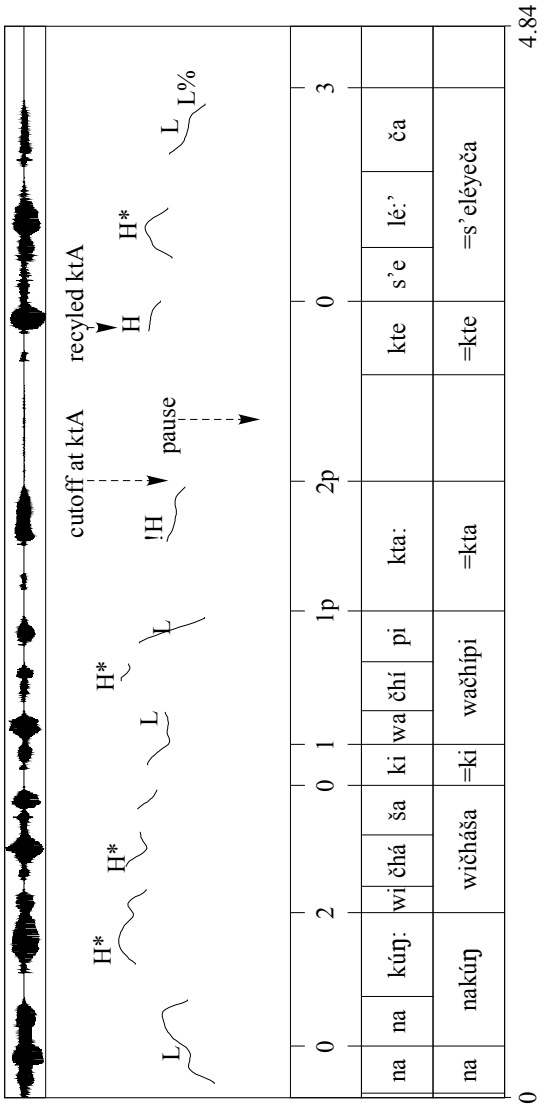


Figure 4.20: Cutoff, recycling, and correction of *ktA* in enclitic phrase-medial position.

Example (78) can be contrasted with contexts in which speaker abruptly stops her speech *before* producing any of the post-*pi* enclitics. A case of *pi*-offset cutoff, followed by a significant (0.7 second) pause, is shown in example (79). Note from accompanying figure 4.21 that, despite the rather long pause after *-pi*, the speaker simply continues with the production of the Class 2 enclitic *-ktA* (realized as *-kte* here). She does not return to an earlier place in the utterance to recycle the plural marker or the verb.

(79) wíŋyaŋ =ki wačhí-pi . =kte

woman =DET$_{def}$ dance-pl . =irr

"The women will dance." [Speaker DBW09:SC]

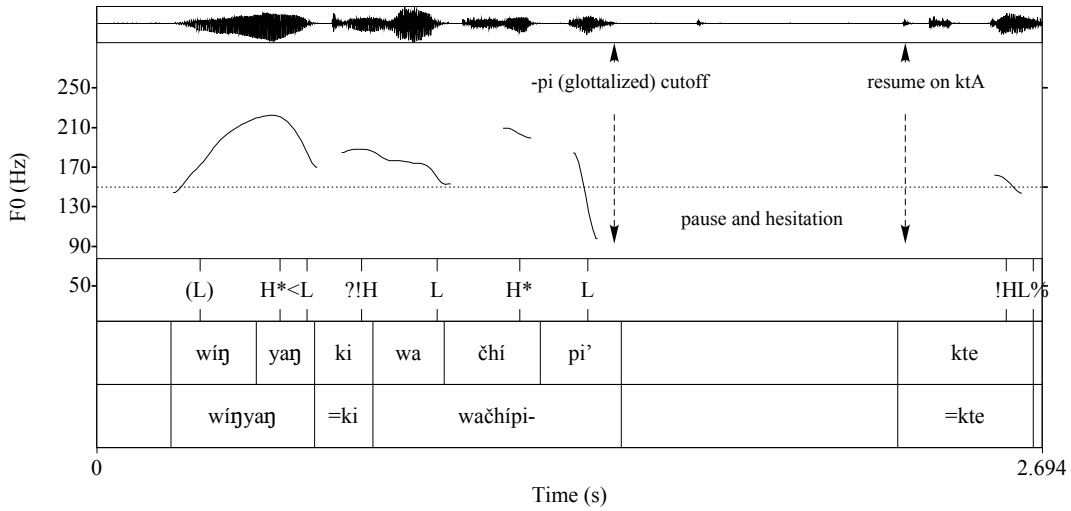


Figure 4.21: Cutoff with pause and hesitation at the offset of plural marker *-pi*. The speaker resumes the talk with the production of the post-*pi* Class 2 enclitic *-ktA*, *without* recycling *-pi* or the verb.

If - for any reason - the speaker abruptly stops her speech during or before *-pi*, then she generally resumes her talk by going back and recycling the verb. An example of an abrupt cutoff during the production of enclitic *-pi* is shown in (80). In this example, *-pi* consistently surfaces phonetically as a voiced stop [b] (i.e., one of the fast speech reduced forms discussed in section 4.2.4). The target utterance in the first phrase

in example (80) is *wačhí-pi =šni*, "they're not dancing". However, on her first attempt, the speaker cuts off her speech during the coda of the last syllable of the verb *wačhíb* (morphologically *wačhí-pi*). The cutoff occurs at a point in time where one can only hear the closure for the final [b]; there is no perceptible release of the stop. After a pause, the speaker goes back to the beginning of the verb in order to recycle and produce the complete phrase *wačhíb =šni*.

(80) *hiyá wačhí(b)- . wačhíb =šni .. lowáŋb*

hiyá wačhí-pi . wačhí-pi =šni .. lowáŋ-pi

no dance-pl . dance-pl =neg .. sing-pl

"No, they're not dancing, they're singing." [Speaker DBW09:SC]

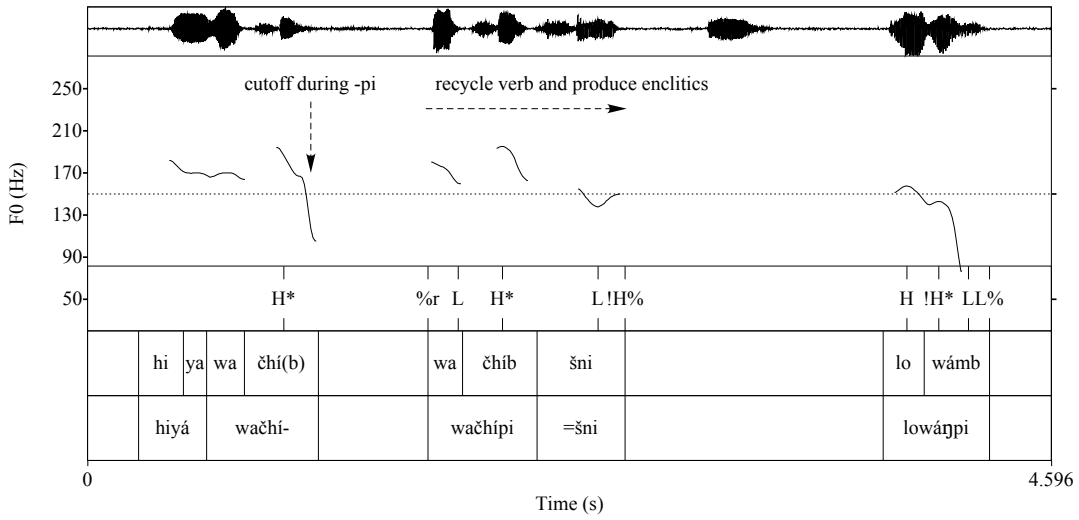


Figure 4.22: Cutoff with hesitation *during* the production of a reduced form of the enclitic *-pi*. The speaker resumes the talk by first recycling the verb. She then continues on to produce the enclitics and remainder of the utterance.

While these observations do not provide a direct proof for the proposed structure, the analysis of the enclitics into three prosodic classes - with the stated preferences - is consistent with the patterns that emerge from the processing of enclitics in real speech.

4.5.3.2 Evidence from Nominal Articles

Another set of observations that favors the idea of a class of enclitics with variable attachment (i.e., Class 2), concerns the prosodic and tonal behavior of the post-nominal unstressed articles *ki* and *waŋ*. While I have not explicitly mentioned it, in many of my transcriptions so far I have also marked the post-nominal articles with the enclitic boundary symbol "=" (see example (78), for instance). Careful inspection of the tonal behavior of these articles shows that they can also display variable attachment.

In particular, in constructions with Noun + $ki_{(DET)}$ + $lená_{(DEM)}$, the article *ki* sometimes prosodically attaches to the left (i.e., to the head noun), while at other times it prosodically attaches to the right (i.e., to the demonstrative *lená*). When the article is prosodically attached to the demonstrative *lená*, the article and demonstrative together usually carry a !H or L!H phrase accent in IP-medial position. In doing so they demarcate an *ip* boundary, thereby blocking downstep into the next phrase. When the article *ki* prosodically attaches to the head noun however, it typically carries the L trailing tone of the (L)H*L core pitch accent that occurs on the noun.

4.5.3.3 Complications with Semi-Independent Items

There are two important complications with the proposed Enclitic Phrase that need to be addressed. First, the parallels I have drawn here between the article *ki* and the post-verbal enclitics are not direct or exact by any means. For instance, the article *ki* exhibits frequent reduction to /g/ in fast speech. This reduced form /g/ closes the final syllable on the preceding head noun. In this, and several other morpho-syntactic respects, *ki* behaves much more like the post-verbal Class 1 enclitic *-pi*, rather than the variable Class 2 enclitics. It may also be unreasonable to expect direct parallels between the post-verbal enclitics and post-nominal articles since the set of post-verbal enclitics in Lakota has many more members.

Second, Class 1 *-pi* itself is not as well behaved as it might seem from the discussion in this section. There are certain frequent, idiomatic constructions in which *-pi* shows attachment to an outer layer (Class 3)

enclitic. For instance, when *-pi* occurs before the command enclitic *yó*, or before the men's speech emphatic declarative *yeló*, it frequently prefixes onto these forms. Subsequent phonological reduction leads to the following compounds: *pi* + *yó* = *pó* and *pi* + *yeló* = *peló*. Clearly there is more work to be done in analyzing the structure of the Enclitic Phrase. In either case, the point remains valid that there are certain semi-independent particle like items in Lakota which display variable prosodic attachments. In the case of post-verbal enclitics, these prosodically variable items can usually be distinguished from the other classes that are either very bound or very free.

4.6 Summary and Discussion of Prosodic Characteristics of Lakota

In this chapter I have described several large scale prosodic characteristics of Lakota. After defining words and word boundaries, I showed that several segmental and suprasegmental phonetic cues can be used to define boundary strengths between adjacent words in Lakota speech. The synthesis of the boundary strength analysis with the tonal characteristics of phrases reveals the types of consistencies that provide evidence for a layered prosodic structure of Lakota utterances. The prosodic levels posited include three levels: the intonational phase (IP), the intermediate phrase (*ip*), and the prosodic word (ω). The higher prosodic levels - consisting of the IP and the *ip* - are defined tonally. The intonational phrase is characterized by the set of tonal, durational, and laryngeal features that accompany the % boundary tone. The intermediate phrase is defined by the phrase accent edge tone, which generally blocks the application of downstep across *ip*s. A tonal definition for ω is possible, but slightly problematic. A more robust definition for the prosodic word relates it to the domain of lexical stress. I argued that the rate of speech influences the prosodic phrasing of words in an utterance, with the general trend indicating that slower speech rates produce more intermediate phrases. In the final part of the chapter, I analyzed the tonal and prosodic properties of several post-verbal enclitics in Lakota. The results of the investigation show that a combination of the tonal, prosodic, and grammatical behavior of the enclitics allows for the identification of an IP-final Enclitic Phrase with internal organization.

Chapter 5

Conclusions

5.1 Summary and Conclusions

At the start of this thesis, I set out to describe intonation and prosodic phrasing in Lakota. To do so, I analyzed sentences from narratives, natural discourse, semi-spontaneous conversations, and elicitations from three Lakota speakers, recorded at different time periods and on different occasions. I presented the analysis and results of the tonal investigation in Chapter 3. Then, in Chapter 4, I outlined a preliminary model of Lakota prosodic structure based on word boundary strengths and intonational patterns. The analysis of Lakota intonational phonology I have provided is based on the fundamental principles of the autosegmental-metrical approach to intonation.

The examination of the declarative and interrogative utterances in Chapter 3 showed that Lakota has intonational pitch accents that are associated with lexically stressed syllables. The most frequent pitch accent type posited has a core LH*L structure which can take on different shapes. The H* pitch accent peaks are frequently aligned on-time with respect to stressed syllables. There are some potentially interesting cases of delayed peaks, as well as a special H*H pitch accent, that still need further investigation. The analysis also revealed that Lakota utterances contain two types of edge tones: phrase accents and boundary tones. I identified three types of phrase accents: L, !H, LH. Of these, the L phrase accent is used by all speakers. The LH phrase accent appears to be used more by the women speakers. I showed that all three phrase accents

arguably display multiple linking in terms of their association to the segmental tier. However, the analysis of the alignment of L phrase accents remains somewhat problematic due to phonetic similarities between L as a phrase accent and L as a trailing tone. Both declarative and interrogative phrases in Lakota frequently exhibit relatively low final boundary tones. The outstanding edge features of interrogative utterances are (i) a !H phrase accent on the clause-final question enclitic *he* and (ii) high pitch levels with more frequent delayed peaks in phrase initial position.

The investigation of the large-scale tonal properties of Lakota declaratives revealed that there are two significant tonal scaling phenomena inside utterances. The first type of scaling involves the localized application of downstep which lowers the peaks of subsequent pitch accents, establishing new high levels in the utterance-in-progress. The second type of scaling concerns the sudden compression of pitch span in, what appears to be, post-focal position. I also showed that, in addition to these scaling events, Lakota declaratives exhibit gradual F0 declination and, frequently, sharp final falls.

My analysis of the prosodic structure of Lakota in Chapter 4 is primarily grounded in acoustic and impressionistic phonetic measurements of word junctures in connected speech. In the first part of Chapter 4, I provided a description of the segmental and suprasegmental phonetic events that frequently take place at word boundaries and showed that, for the most part, these observables provide good measurements for coding word-juncture break indices. The segmental correlates involving phonological reduction highlight negative boundary strengths, corresponding to zero or negative break index values. Stronger word boundary strengths, corresponding to larger break index values, are best measured via the accumulation of suprasegmental cues such as lengthening, pause, and tonal movements.

In the second part of Chapter 4, I synthesized the boundary strength analysis with the tonal properties of Lakota utterances and showed that the results of the combined analysis provide strong evidence for a three-layered prosodic structure. These layers, from largest to smallest, include the Intonational Phrase (IP), the Intermediate Phrase (*ip*), and the Prosodic Word (ω). The IP and *ip* are primarily defined based on their tonal properties. The IP is identified by the % boundary tone, with accompanying pitch and declination

reset. The *ip* is best defined as (i) a unit marked by a phrase accent edge tone and (ii) a domain that limits the application of downstep. I argued that explicit recognition of the intermediate phrasal category allows for a more generalized definition of phrase accents and clears away some of the difficulties regarding the interpretation of the trailing L tone in LH*L core pitch accents. In particular, I showed that the trailing L tone of the LH*L pitch accent is only weakly bound to the H* nucleus and that this weak binding manifests phonetically in different ways. I argued that in certain morpho-syntactic and discourse contexts these loose trailing L tones function as phrase accents, segmenting the IP into smaller *ip*s. For the lowest layer, the Prosodic Word (ω), I adopted a definition based on the domain of application of the Dakota Stress Rule. This stress-based definition of the ω implies that constructions like syntactic compounds constitute two prosodic words (but one grammatical word) in Lakota.

The strings of post-verbal, phrase final enclitics remain problematic for the definition of ω. In the last part of Chapter 4, I examined the phrasing of these enclitics based on a small sample of experimental data. The results show that in terms of their tonal, prosodic, and phonological properties the post-verbal enclitics display an internal organization. Some of the outer layer enclitics have the capability of forming phrases of their own, under the right conditions. However, the phrase formed by these enclitics remains somehow subordinate to the head ω to which they are attached. The analysis of an internally organized Enclitic Phrase is further complicated by the fact that several of the enclitics display variable attachment to items in their neighborhood. More research on enclitics and semi-independent particles is needed in order to fully understand their prosodic status.

5.2 Consequences and Directions for Future Research

The analysis of Lakota intonation and prosody I have provided in the current study is neither complete, nor without problems. I have alluded to several ambiguities at various points throughout the document. In what follows, I discuss some of the complications at some more length. In the process I outline some interesting and fruitful lines of future research in Lakota intonational phonology.

5.2.1 Issue of Primary Pitch Accent

One issue that I have only touched upon, but never elaborated on, is the question of a primary pitch accent in Lakota phrases. Primary pitch accent is frequently referred to as nuclear, or focal, pitch accent in the literature on intonational phonology. The idea behind a nuclear accent is that there is one pitch accent that is the primary and obligatory accent in a given phrase. The nuclear accent is usually the last pitch-accent in an intermediate phrase. At least in several European languages, the nuclear pitch accent is said to play an important role in cueing the focal constituent in a phrase.[1]

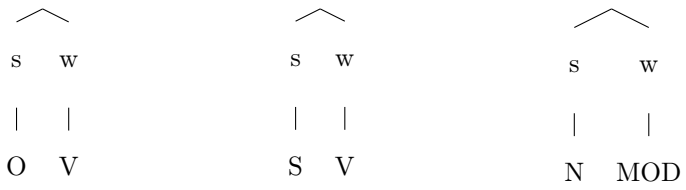
In Chapter 3 I showed that Lakota intonational phrases consist of major category words, each of which usually carries one of the (L)H*(L) maximal core pitch accent patterns. Later, in Chapter 4, I stated that each *ip* must carry at least one major pitch accent. However, when the *ip* consists of two or three major category words, each with its own pitch accent, the analysis does not state whether there is one pitch accent that is more obligatory than the others. Is the last pitch accent in the intermediate phrase in Lakota in any sense more primary than the previous pitch accents? Furthermore, it is not clear at this point if there is a primary pitch accent in the *ip* that plays any special role in "signaling" a focal constituent. The fact that there are some contexts in which, past a certain point in the utterance, major-category words get de-accented (see, for instance, example (26), page 101) suggests the possibility of a nuclear/focal accent as the last pitch accent in a phrase. However, there are many cases in the data where such de-accenting does not happen, and yet the last accent does not seem relevant to a focus interpretation either. Furthermore, in Chapter 4 I cited utterances, such as the one in example (68), where (a) morphological marking by the article *čha* and (b) separation into own-*ip* are what signal the primary-ness of a particular unit from a focus perspective. That is, the question of a primary unit in Lakota intonational phrases may be one of combined morphology and metrical-prosodic structure rather than pitch accent.

[1] I should add that, even within the context of European languages, there are various and assorted complications with the idea of a nuclear accent. A complete elaboration on the issues involved would take this conclusion chapter too far afield. The relevant references in Ladd (2009) provide a comprehensive overview of all the issues.

The primary pitch accents puzzle also brings to surface the issue of predicate focus interpretation in Lakota sentences. Some recent AM studies of intonation have argued that the last accent in a phrase has a special structural status. Namely, it is claimed that the "location of the last accent determines whether a broad focus interpretation of a sentence is possible" (Ladd 2009:257-259). The theory claims that in English, for example, in order for a noun phrase consisting of a modifier plus noun to be interpreted as "focus on entire NP constituent", the last accent in the constituent must be on the noun. In such contexts, the last accent is not necessarily phonetically prominent. Rather, there is a metrical weak-strong relationship between the modifier and the noun that signals focus. The metrical structure is seen as more central to the interpretation of focus, and the pitch accents are demoted to being only one possible manifestation of this internal organization.

Based on my data analysis so far, I believe that a metrical and prosodic phrasing view is better suited for understanding predicate focus constructions in Lakota. This view is supported by examples like (68) in which a focused constituent breaks into its own intermediate phrase. Furthermore, there are plenty of utterances in the database in which a pitch accent does not appear to signal any focus. However, given the metrical-prosodic view, there are language specific questions that need to be sorted out. Unlike many of the languages studied within the AM approach so far, Lakota exhibits (a) a rather fixed SOV word order with a strong preference for head-modifier constituency, and (b) a preference for strong-weak metrical organization above the lexical level of the DSR foot construction. One consequence of these mutual structural preferences is that, frequently, Lakota transitive and intransitive clauses with predicate or sentence focus have a strong-weak metrical structure. This is also true of the typical order in noun-modifier sequences. The strong-weak relationships in Lakota can be represented metrically as follows.

Diagram 9



In such clauses in Lakota, under predicate or entire-constituent focus interpretations, the noun and the verb (or the noun and its modifier) form a single *ip*. Within this *ip*, it is the weak node (i.e., the verb or the modifier) that typically carries the last pitch accent. Is this accent on the verb primary or secondary? Clearly, there is a lot of basic data analysis to be done in the area of pragmatic focus and prosodic organization in Lakota intonational phonology. In addition, a thorough analysis of predicate focus constructions in Lakota may provide a better understanding of the H*HL pitch accent discussed in section 3.3.3.6.

5.2.2 Pitch Range and Nested Prosodic Domains

One of the outstanding ambiguities in the present analysis of Lakota intonational phonology concerns the relation between de-accenting and the tonal scaling phenomenon of sudden, extreme, pitch span compression. The extreme pitch span compressions in Lakota utterances often lead to the perception of de-accenting, yet within the compressed pitch range it is is still possible to distinguish a slight pitch bump on the expected locations of H* peaks. This is an area of phonetic analysis that will need to be explored in the future.

Another interesting pitch range phenomenon that needs further analysis concerns the scaling relations between different phrases in connected speech. At the start of my analysis of the Lakota narratives I noticed certain pitch range relationships between sequences of *ip*s that are strung together into a long unit. This observation was the original motivation for including an explicit pitch range tier in the LaToBI coding scheme (see section 2.5.3.6). While I have not pursued this matter to any depth here, it would be interesting to explore whether these long strings of *ip*s - along with their associated pitch range relations - can be incorporated into the prosodic phrasing posited in Chapter 4.

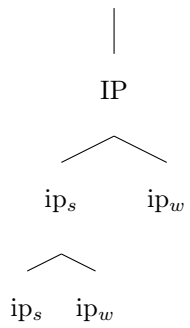
The pitch range observations may also be indirectly related to the unexplored focus issues I discussed earlier in section 5.2.1. As already mentioned, there are many intermediate phrases in the Lakota data with primary (H*) accents that apparently do not signal any focus. In the light of the strings of *ip*s and pitch range relations mentioned, it might be possible to re-interpret the question of focus in terms of dependencies

between prosodic phrases. For instance, if the model of the layered prosodic structure is extended to include nested *ip*s, it might be possible to analyze a string of intermediate phrases such as:

[{LH* !H* L}$_{ip}$ {H* L!H* LH}$_{ip}$ {H* !H* L }$_{ip}$]$_{IP}$ L%

in terms of a more complex intermediate phrase with a metrical organization that allows for interpretation of focus amongst sets of intermediate phrases.

Diagram 10



These issues, though interesting, remain speculative until an analysis of more complex Lakota phrases is achieved and the issues surrounding focus interpretations have been addressed. Furthermore, the analysis of more sentence types, such as embedded quoted speech, would contribute immensely to a discussion of the puzzles presented here.

5.2.3 Data, Speakers, and Comparative Studies

In addition to the issues concerning focal pitch accent, pitch-range, and prosodic organization discussed above, there are certain trends and aspects of the data itself that need further exploration.

At a few points in this study I have remarked that the stated results show curious differences with respect to gender and age of speaker. For instance, I commented that the LH phrase accent is used more frequently by the women speakers represented in this database, and that, amongst the women speakers the contemporary speaker appears to use it more frequently. However, the question still remains as to whether

this observation is due to (a) differences in speech between men and women, (b) generational differences, or (c) differences in individual speech styles. Since the original goal of my investigation here was to lay out the foundations for the study of Lakota intonational phonology, I have not had the opportunity to explore these matters in detail. As a first step towards understanding gender and generational differences, it would be very useful to obtain and analyze more data from contemporary men and women speakers. One of the shortcomings of the current study is that contemporary men speakers are not represented in the data.

Concerning the generational differences, there is a potentially very significant factor that I would like to comment on. Since almost all contemporary Lakota speakers are fluent bilinguals in Lakota and English, it would be interesting to explore how the intonational systems of the two languages interact for these speakers, and if this interaction is what gives rise to the observed generational differences. For these fully bilingual speakers the influence may even be bidirectional; that is, the intonational system of their Lakota may also influence the intonational system of their English. If we assume that in terms of linguistic evolution intonational phonology is similar to other aspects of language, then changes in the intonational system of a language may develop either through language internal mechanisms or through external influences. These external influences can include things like bilingualism, language contact, and the pressure of language shift.

I assume that any investigation of such questions would have to first develop a standard of measurement for the differences and similarities in the intonational systems of the varieties of the two languages that are in contact. If we take, in a very simplified sense, the results from this investigation as a representation of "Lakota intonation", we can begin a preliminary investigation by noting some intonational differences between this variety of Lakota and perhaps some form of "standard American English". For instance, just based on impressionistic observations, there are some obvious edge tone differences in interrogative utterances in the two languages. There are also differences in the inventory of pitch accent types; English displays L* and H* accents, while the Lakota data here displays only H* accents. In terms of metrical structure, both languages seem to display the same levels of prosodic organization. However, the preferences for strong-weak versus weak-strong ordering of elements in the metrical structure show significant differences. Given

these observations, one can ask several fundamental questions. What intonational features in the speech of Lakota-English bilinguals are due to being bilingual? Would these bilingual speakers use predominantly one intonational system or would they use a mixed system that adopts various intonational features from both languages?

Along these lines of research, some interesting cross-language influences in the lexical stress system have been studied. Shaw (1985) documents the relatively recent development of a second stress rule, in addition to the original Dakota Stress Rule (DSR), in the lexical phonology of the Stoney dialect of Morley, Alberta. Shaw refers to this innovative stress rule as the Stoney Stress Rule (SSR). The SSR is very different from the DSR, both in terms of foot formation and in the way that syllables are incorporated into the metrical word tree. In addition, the SSR has final consonant extrametricality. Shaw argues that, based on a metrical framework, the basic parameters of the SSR are nearly identical to the analysis of the English Stress Rule in Hayes (1982). If this result is indicative of metrical interactions between English and Stoney, then it is not unreasonable to expect some cross-language influences in other parts of the prosodic and intonational systems as well.

This study of Lakota intonation and prosody ends here, perhaps with more questions than answers. I hope, however, that the fundamental structure of Lakota intonational phonology laid out in this thesis provides a solid foundation that can be extended and elaborated by future research.

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Appendix A

Database of Lakota Phrases and Words used for the Analysis

This appendix consists of several tables that display the subsets of phrases used in the current analysis of Lakota intonation and prosody. The tables represent data pieces from all three Lakota speakers. The tasks that the participants perform include autobiographical narratives, an older historical narrative, a newer historical narrative, natural conversations, scripted conversations, and elicitations. These are discussed in Chapter 2, in sections 2.2.1 and 2.3.1. Note that - as already indicated - the tables display only subsets of the entire collected data, after the appropriate filtering criteria described in section 2.3.2 have been applied. As a result, the tables displaying phrases from the continuous narratives may appear to have "discontinuities" at certain points. These apparent discontinuities are not inherent to the narratives; they are merely a result of the partial presentation of the data in this appendix.

The Lakota phrases are shown in a phonemic transcription that closely matches the orthographic conventions outlined in Ullrich (2008). In addition, I employ several discourse-level diacritics in the transcriptions. Parentheses {(.), (..), (...)} in the Lakota lines symbolically represent short, medium, and longer pauses, respectively. These pauses or breaks can occur either in the middle of an utterance or near its edges. A hyphen {-} inside, or at the boundary, of a Lakota word indicates an abrupt hesitation (i.e., a self-repair cutoff) by the speaker at that point in the speech. The temporal durations of the pauses (in milliseconds) can be calculated from the transcriptions of word boundaries in *Praat*. The complete *Praat* files also include tiers displaying narrower phonetic transcriptions of the Lakota words.

Table A.1: The subset of Lakota phrases from speaker Sofie One Feather (Narrative, 1973) included in the analysis. The header of the left column indicates the task and speaker code (SOF73:N, in this case). The number in the left column indicates the order of the phrases from the portion of the narrative presented. The middle column displays the Lakota phrases, along with a free English translations. The right column indicates the modality type for each sentence. All the sentences analyzed from this task, by this speaker, are of the declarative type.

SOF73:N	**Lakota Phrase** English Translation	Utterance Type
1	**uŋčíkčik'alapi k'uŋ héhaŋl ȟeyáta**	
	When we were small in the country,	
	kákhiya Reverend Patrick Shields até'uŋyaŋpi	decl.
	back there, we had Reverend Patrick Shields as Father.	
2	**wačhékiye wičháša héčha**	decl.
	He was a preacher.	
3	**ho-héčhiya (.) até pteyúha**	decl.
	Well there, my father was a rancher.	
4	**šúŋkawakȟáŋ na ptewániyaŋpi líla óta wičhá'uŋyuhapi**	decl.
	We had really lots of horses and cattle.	
5	**na héčhiya (.) uŋthípi**	decl.
	And there, we lived.	
6	**yuphíya (..) obláye waŋ ektá uŋthípi**	decl.
	Comfortably, we lived on a level place on the prairie.	
7	**até'uŋyaŋpi ki naháŋ (..) makȟá yublú na wóžu**	decl.
	Those we had as fathers and, till the soil and raise crops ...	
8	**wóžu naháŋ (..) líla taŋyáŋ uŋk'úŋpi héčhiya**	decl.
	farmed and, we lived very comfortably there.	
9	**makȟóčhe ki líla o'íyokiphi**	decl.
	The land was very pleasant.	
10	**léčhel wakpála waŋ ȟpáyiŋ na hél (..) mayákaksaksa waŋkátuya**	decl.
	Like this [?gesture] a river came down and there ... the cut banks were high ...	
11	**na ȟaŋté kȟó ožú naháŋ (..)**	
	and junipers grew as well and ...	

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SOF73:N	**Lakota Phrase** English Translation	Utterance Type
	waskúyeča čhaŋpȟá (..) kȟáŋta (..)	
	fruit trees, chokecherries ... plums ...	
	kȟáŋta (.) and (..) maštíŋčaphuté (..)	
	plums and ... buffalo berries ...	
	and uh (..) uh táku (..) čhuŋwíyapehé	decl.
	and uh ... uh what else ... grapes	
12	**toháŋtu čháŋašna wakȟáŋyeža ki íyuha**	decl.
	at certain times all of the children	
13	**iná ób uŋkíyayapi na (..)**	
	we went with my mother and ...	
	wó'uŋšpipi na uŋkáglipi čháŋnašna áyataya (..)	decl.
	we picked fruits and when we came back, [emphatic]	
14	**iná'uŋyaŋpi ki naháŋ (..) na waskúyeča káğiŋ na (..)**	
	those we had as mothers and so ... made sweets and ...	
	čhaŋpȟá ki húŋȟ pusyápi na	decl.
	they dried some of the chokecherries and ...	
15	**ho hehán̈l akhé wagmíza kȟó pusyápi na**	decl.
	and so again they also dried corn, and ...	
16	**thíŋpsila woptápi na (..)**	decl.
	they dug wild turnips and ...	
17	**hená súŋpi na waníyetu čháŋna hená yútapi**	decl.
	they braided them and when it was winter they ate them.	
18	**waníyetu čháŋ o-'íyokiphi líla**	decl.
	When it was winter, it was very pleasant.	
19	**ptewániyaŋpi ki wówičha'uŋk'upi**	decl.
	The cattle, they fed them.	
20	**aŋpétuwakȟáŋ ki hé**	decl.
	Sunday, that ...	
21	**wóčhekiye ki hečéla uŋ uŋkíčhağapi héčhi ȟeyáta**	decl.
	With only that prayer we grew up, back there in the country.	

Table A.2: The subset of Lakota phrases from the narrative by speaker Paul Red Star (Wounded Knee, 1973). The sentences from this narrative represent declarative, emphatic, and quotative types.

PRS73:N	**Lakota Phrase** English Translation	Utterance Type
1	**AIM ewíčhakiyapi ki hená hél hiyúpi nahą́ŋ** The ones they call AIM, they came down into there and then ...	decl.
2	**hógna (.) Pȟahíŋ Siŋté héčhi wačhípi kta (.) yápi** Through there, they were on their way to a dance at Porcupine.	decl.
3	**mas'óphiye waŋ él inážiŋpi nahą́ŋ** They stopped at a store and then ...	decl
4	**wígli (.) lápi yuŋkȟáŋ wičhák'up šni kéyapi yeló** Gasoline, they asked for it but they say that they didn't give it to them.	quot. emphatic
5	**mas'óphiye yuhápi ki hená (.) owíčhayuspapi nahą́ŋ** The store owners, them ... they seized them and then ...	decl.
6	**wayáka i- iwíčhačupi iyéčhel wičháyuhapi nahą́ŋ** Captives, taken as if (like that) they had them, and then ...	decl.
7	**state marshall eyá tókhiyataŋ hípi nahą́ŋ** Some State Marshall, they arrived from somewhere, and then ...	decl.
8	**čhaŋkú ki áta-iyúha natȟákab čha** They blocked all the roads, so ...	decl.
9	**iyáyapi okíhip šni** They could not go do anything.	decl.
10	**hél thí kiŋháŋ omníčiye yuhápi nahą́ŋ** The community that lived there, they had a meeting, and then ...	decl.
11	**húŋȟ wičhákaȟniğapi na úŋ** They selected some people and from that ...	decl.
12	**inápȟapi kta (..)** They would go out, **na wóyute íč'ignipi kta (..) i:: o- omníčiye** and find food for themselves, uh, there was a meeting.	 decl.
13	**slolyápi čhíŋpi** They wanted to know (some specific information).	decl.
	Continued on Next Page...	

PRS73:N	**Lakota Phrase** English Translation	Utterance Type
14	**táku wólakȟota káğapi óta**	
	They had some kind of a treaty, many	
	okípȟap šni (..) glušnápi	decl.
	they did not follow it, they made mistakes.	
15	**na awíčhaktapi šni la (.) lehá ŋ**	decl.
	And they did not respect them, up to this day ...	
16	**Lakȟóta kihá ŋ (..) táku (.) wó'ikigni (..)**	
	The Lakotas, some things, resources,	
	yuhápi wa ŋ hená (..) iyópteyapi šni	decl.
	[the things] that they have, those ... they did not fulfill them.	
17	**leháŋl Lakȟóta kihá ŋ**	
	Nowadays, the Lakotas,	
	líla iyótiyekiyapi škhe	quot.
	they have a very difficult and distressing time, it's said.	

Table A.3: The subset of Lakota phrases from the *Matȟówiŋ* Narrative by Della Bad Wound (2006). The phrases in this subset include several types of sentence modalities, including declaratives, irrealis, and quotatives).

DBW06:N	**Lakota Phrase** English Translation	Utterance Type
1	**cha lakȟótiyawayiŋ kte**	irrealis
	So, I will speak in Lakhota	
2	**mitákuyepi**	calling
	My relatives,	
3	**čhaŋté waštéya iyúha naŋpé čhiyúzapi**[1]	decl.
	With all good heart I shake hands with you all.	
4	**optébyela wówaglakiŋkte čha taŋyáŋ anáǧoptaŋ yaŋkápi**	imp.[2]
	I'll be talking for a little while and so sit down and listen carefully.	
5	**eháni (.) wóoglakapi héča čhaowáglakiŋ kte**	irrealis
	Long time ago, the things that they spoke, those, I will narrate my own.	
6	**očhíčakapi miŋš'éya wačhíŋ**	decl.
	I also want to tell it to you.	
7	**eháni (.) lakȟóta oyáte ki (...) wičhóthi (..)**	
	Long time ago, the Lakota people, camp,	
	tȟáŋka yuhápi	decl.
	a large one they had.	
8	**waníyetušnihani éyaš na áta íyuha (.)**	
	When it wasn't winter yet they all gathered	
	ptaíč'iyab našná (.) wíkignipi	decl.
	gathered together and often looked for provisions.	
9	**húŋȟ tȟatȟáŋka olébni:š a::m (..)**	
	Some of them hunted for buffalo or else, uh	
	takúku (.) šna (.) ikígnipi	decl.
	various things, usually, they searched for.	
10	**yuŋkȟáŋ lé aŋpétu (.) waŋ él (...) wičháša ki wakhúl iyá:pi**	decl.
	And then, on this one day, the men went out to hunt.	
	Continued on Next Page...	

[1] This is an idiomatic phrase, frequently used in introductions. See example (16) in Chapter 3 for a discussion of this phrase.
[2] The imperative enclitic *ye* has been omitted in this sentence. This enclitic is frequently dropped in natural speech, especially among women speakers.

DBW06:N	**Lakota Phrase** English Translation	Utterance Type
	.....	
11	**pȟé ektá á:ta óta**	decl.
	On top of their head lots and lots ...	
12	**maštíŋčaphuté lí:la óta**	decl.
	There were A LOT of buffalo berries.	
13	**áta wóšpi ibktá kéyab na**	
	And so it is said that they would arrive (there) to pick berries and	
	áta iyúha iglóiyaŋpi na ektá ípi ke'	quot.
	they took themselves there and arrived there.	
14	**wóžuha él okígnakapi ké**	quot.
	They put their own stuff in their bags, they say	
15	**iȟát'at'a áta (..) wóglaglag nážiŋp ké**	quot.
	Really laughing, they stood around talking and talking, they say.	
16	**táku waŋ naȟ'úŋb čha ata 'iyú inážiŋpi ké**	quot.
	They heard something and then everyone just stopped, they say.	
17	**matȟósapa čha hinážiŋ čha**	decl.
	A black bear it was that stood there so ...	
18	**wičhíŋčalala waŋ líla čístilala čha (..) kȟó ópȟa ké'**	quot.
	A girl that was really small, also followed, they say.	
19	**á:ta húŋku ki i- (.) ihákab (..) íŋyaŋka ké'**	quot.
	So, really, her mother, she ran behind her, they say.	
20	**húpteptečelala čha (.) hehéŋ (..)**	
	Since her legs were really short, by that time	
	yá okíhi šni ké'	quot.
	she could no longer go, they say.	
21	**nihíŋčiya ǽš (..)**	
	She panicked though,	
	iyúha wíŋyaŋ ki iyǽb čha é na iyótakiŋ	
	because all the women, they left, and so she sat down	
	na á:ta čhéya iyǽ ké'	quot.
	and really started crying, they say	

Continued on Next Page...

DBW06:N	**Lakota Phrase** English Translation	Utterance Type
22	**iyóhomniyaŋ (..) iyáyiŋ na ómnamna kéya** around her, it (the bear) went and smelled her, it's said.	quot.
23	**waná mayáȟtakiŋ níš ma- thebmáyiŋ kte ečhíŋ ké'** "Now he will bite me andhe will it me up", she thought, it is said.	
24	**matȟó ki (...) á:ta ečháŋl (.) slíslipa ké'** The bear, really just then, unexpectedly, licked and licked her, it is said.	quot.
25	**slíslipiŋ na (...) uh kigná ké'** It licked and licked her, and, umm, it comforted her, they say.	quot.

Table A.4: The subset of Lakota phrases from the autobiographical narrative by Della Bad Wound (2009). The phrases from this subset mostly represent declarative sentence types.

DBW09:N	**Lakota Phrase** English Translation	Utterance Type
1	**oháŋ lé- (..) ptéčela wówaglakiŋ kte** OK, this ... I will talk about things for a short time.	irrealis.
2	**eháni (.) kakáwičháwaye ki(.) uh waŋží (.) čhažé k'úpi** Long time ago, my grandfather, one of them, they gave him a name.	decl.
3	**tȟaópi šíča ečíyapi** They named him Bad Wound	decl.
4	**čhažé ki íyuha uŋ- (.) thiyóšpaye ki uŋyúhapi** Everyone uses that name, we have it in the extended family.	decl.
5	**oyáte ki (..) uh (..) nakúŋ ówičhakiye** The people, umm, he also helped them, ... **kakáwaye ki hé** ... that grandfather of mine.	decl. tag / decl.
6	**lehán̈l waší̈čuya "head man'' ečíyapi** These days in English they call them "head man".	decl.
7	**itȟa- uh iyé thiyóšpaye ki awáŋwičhaglake** The leader, umm, he took care of the extended family	decl.
8	**eháŋni waŋblí hoȟpí él matȟúŋpi** Long time ago I was born at Wanblee, SD	decl.
9	**na hél imáčhaǧe** And I grew up there.	decl.
10	**uh, wabláwa na wówaši ečhámuŋ** Umm, I studied, and I worked.	decl.
11	**yuŋkȟáŋ lehán̈l waná káŋ amáhi čha miglúštaŋ**[3] And these days, now, I have finished getting old.	decl.
12.	**(...) ikčéya wi- (...) ób šna wičháwaškate** ... [phrase with cutoffs] ... I often play with them.	decl.
13	**čha óiyokphiya lehán̈l wa'úŋ** So, these days I live happily	decl.
	Continued on Next Page...	

[3] Unsure of transcription and gloss.

DBW09:N	**Lakota Phrase** English Translation	Utterance Type
14	**líla (..) wóyute ki (..) thewáȟila** I really like food a lot.	decl.
15	**wahápŋpi wašté na wígli'uŋkáğapi ki líla waštéwalake** I really like good stew and fry-bread.	decl.
16	**na nakúŋ tȟaspáŋ opémnipi hé líla waštéwalake** And also, I really love apple pie.	decl.
17	**watóhaŋl šna čháğa sní (.) ča o- akáŋšna éwagle s'a** Now and then I often put ice-cream on top of it.	hab. decl.
18	**lehápŋl wówapi (..) ekčéya- ekčékeya (..) blawá s'a** Nowadays, um, I often read books.	hab. decl
19	**na líla w- (.) a- wayáwa waštéwalake** And, um, I like reading a lot.	decl.
20	**máške ób šna (..) líla šna ób omáwayani** Often with my friends, very often I travel around with them.	decl.
21	**mázaská ognákab na takúku mázaská watóhaŋl šna** The thing they put the money in, and various (amounts?) of money, and now and then,	
	naslúte héčhiya šna uŋyáŋpi it comes slipping out, regularly we go there.	decl.
22	**uŋkómanib hé líla waštéwalake pahá (.) Paháska héčhiya šna uŋkíhunib** That we travel around, I like that a lot, hill - usually we go to the general area of Fort Robinson.	
23	**ča héčhel lehápŋl líla oíyokphiyata wa'úŋ** So, in that way, nowadays, I live very happily.	decl.

Table A.5: The subset of Lakota phrases from the scripted conversations with Della Bad Wound (2009) included in the analysis. The phrases in this table are divided into sections called "scenes". Each scene presents a particular context for which short question-response conversations were prepared in advance. The phrases from these tasks represent interrogatives, as well as various other modalities that are coded by the Lakota post-verbal enclitics. The right hand column, labeled "Modalities", specifies the types of enclitics that are used in the question and response sequences. In the right hand column, Q labels "question" and R labels "response". The questions and responses are labeled numerically in order, for each scripted sequence. When there are several responses to a given question, the response numbers are followed by lower-case alphabetical letter codes.

DBW09:SC	**Lakota Phrase** English Translation	Modalities
Scene 1	**Wačhípi ektá** : "At the Dance"	
Q1	**ȟtálehaŋ wačhípi ektá tuwá wačhí he** Yesterday at the dance, who danced?	interr.
R1a	**wičhínčala ki wačhípi kštó (.)** The girls danced. However, the boys, they did not dance.	emph. decl.
R1b	**eyáš hokšíla ki na- (.) -kúŋ wačhí- (.) nakúŋ wačhípi šni** However, the boys, they did not dance.	decl. neg.
Q2	**haŋhépi ki tuwá (.) čha wačhípi kta he** Who all is going to dance tonight?	irrealis interr.
R2a	**wíŋyaŋ ki wačhípi- (..) kte** The women will dance.	irrealis
R2b	**na nakúŋ wičháša ki wačhípi kta (..) kte s'eleča** And also, it seems that the men will dance too.	irrealis
R2c	**David wačhís'a éyaš haŋhépi ki wačhí kte šni ké** David usually dances, but tonight they say that he's not going to dance.	irrealis neg. quot.
R2d	**na nakúŋ Chuck wačhí kte s'eleča yunkháŋ wačhí kte šni ké** And also, it seemed that Chuck was going to dance, but now they say he won't dance.	irrealis neg. quot.
Q3	**haŋhépi ki wakáŋpi ki (..) lená wačhípi kte šni he** Aren't these elders going to dance tonight?	irrealis neg. interr.
R3	**háŋ, wakáŋpi ki lená wačhípi kte šni kéyapi** Yea, they say that these older ones are not going to dance.	irrealis neg. quot.
	Continued on Next Page...	

DBW09:SC	**Lakota Phrase** English Translation	Utterance Type
Scene 2	**Omáyani ki** : "The Walk"	
Q1	**híhaŋni omáyani ki táku ča waŋláka he**	interr.
	And you, when you went for a walk this morning, what did you see?	
R1a	**ziŋtkála óta waŋwíčhablake**	decl.
	I saw a lot of birds.	
R1b	**waŋblí waŋ waŋbláke na**	conj.
	I saw an eagle, and	
	tȟašíyagmuŋka waŋbláke na	conj.
	I saw a meadowlark and	
	ziŋtkála waŋ thó ča nakúŋ waŋbláke	decl.
	I also saw a blue bird.	
Q2	**na wamákhaškaŋ etáŋ nakúŋ waŋwíčhaláka he**	interr.
	And did you see any animals?	
R2a	**háŋ, matȟó waŋ líla tȟáŋka ča (.) waŋbláke na**	conj.
	Yes, I saw a really large bear, and	
	áta síwagluha (..) **iyáwakiye**	decl.
	carrying my own feet, I escaped!	
R2b	**na tókhiyataŋ áta iyéčhiŋkiŋyaŋke waŋ hinážiŋ ča**	decl. rel.
	And from somewhere a car came and stopped,	
	hé nakúŋ waŋbláke	decl.
	I saw that too!	
	háŋ.	interj.
	Yes.	

Table A.6: The subset of Lakota scripted phrases produced by Della Bad Wound (2009). These phrases were obtained based on short, imaginary conversational style question-response exchanges. There are three imagined scenarios, labeled as sets A, B, and C in the table. These scenarios are named *Otúȟ'aŋ* ("Donate"), *K'ú* ("Give"), and *Ečhúŋ* ("Do"). Most of the questions were answered with one sentence. When a question was answered in several slightly different ways, these various responses are all shown after the question. This subset of data represents mostly declarative and interrogative sentence types. However, other modalities (including irrealis, negation, and conjecture) are used as well. Notice also that the data has been formulated in a manner so as to indirectly elicit different types of *focus* structures (i.e., narrow focus on subject, object, quantifier, or verb).

DBW09:S	**Lakota Phrase** English Translation	Modalities
Set A	**Otúȟ'aŋ** : "Donate"	
1	**tuwá mázaská otúȟ'aŋ he** Who donated money?	interr.
2	**David mázaská otúȟ'aŋ** David dontated money.	decl.
3	**Chuck táku otúȟ'aŋ he** What did Chuck donate?	interr.
4	**Chuck hayápi otúȟ'aŋ** Chuck donated clothes.	decl.
5	**Chuck hayápi čha otúȟ'aŋ** Chuck donated clothes.	decl.
6	**Will ağúyapi otúȟ'aŋ he** Did Will donate bread?	interr.
7	**háŋ, Will ağúyapi otúȟ'aŋ** Yes, Will donated bread.	decl.
8	**David hayápi otúȟ'aŋ he** Did David donate clothes?	interr.
9	**hiyá, David mázaská čha otúȟ'aŋ** No. David donated money.	decl.
	Continued on Next Page...	

DBW09:S	**Lakota Phrase** English Translation	Utterance Type
10	**David hayápi otúȟ'aŋ he** Did David donate clothes?	interr.
11	**hiyá (..) Chuck éčha hayápi otúȟ'aŋ** No. It was Chuck who donated clothes.	decl.
Set B	**K'ú** : "Give"	
12	**táku nič'úpi he** What did they give you?	interr.
13	**wówapi waŋ mak'úpi** They gave me a book.	decl.
14	**táku nič'úpi he** What did they give you?	interr.
15	**wówapi waŋ éna mázaská eyá mak'úpi** They gave me a book and some money.	decl.
16	**táku nič'úpi he** What did they give you?	interr.
17	**wówapi yámni mak'úpi** They gave me three books.	decl.
18	**wóyute nič'úpi he** Did they give you food?	interr.
19	**háŋ, wóyute mak'úpi** Yea, they gave me food.	decl.
20	**wóyute nič'úpi he** Did they give you food?	interr.
21	**hiyá, wóyute mak'úpi šni** No, they didn't give me food.	decl. neg.
22	**wówapi čha (.) mak'úpi** They gave me a book.	decl.
	Continued on Next Page. . .	

DBW09:S	**Lakota Phrase** English Translation	Utterance Type
23	**wóyute nič'úpi he**	interr.
	Did they give you food?	
24	**hiyá, wóyute mak'úpi šni wówapi waŋ é na mázaská ča mak'úpi**	decl. (long)
	No, they didn't give me food, it was a book and money that they gave me.	
25	**wówapi núm nič'úpi he**	interr.
	Did they give you two books?	
26	**hiyá (..) wówapi (..) yámni ča mak'úpi**	decl.
	No, they gave me *three* books.	
27	**wól nič'úpi kta he**	irrealis interr.
	Will they give you food?	
28	**hiyá, wóyute mak'úpi kte šni**	irrealis neg.
	No, they won't give me food.	
29	**mázaská (..) etáŋ ča mak'úpi kte séče**	irrealis conj.
	They'll probably give me some money.	
Set C	**Ečhúŋ** : "Do"	
30	**wakȟáŋheža ki hená táku ečhúŋpi he**	interr.
	What are those children doing?	
31	**wakȟáŋheža ki hená wačhípi**	decl.
	Those children are dancing.	
32	**wakȟáŋheža ki hená wačhípi he**	interr.
	Are those children dancing?	
33	**háŋ, wakȟáŋheža ki hená wačhípi**	decl.
	Yes, those children are dancing.	
34	**wakȟáŋheža ki hená wačhípi he**	interr.
	Are those children dancing?	
35	**hiyá, wačhípi šni**	decl. neg.
	No, they're not dancing.	
	Continued on Next Page. . .	

DBW09:S	**Lakota Phrase** English Translation	Utterance Type
	wakȟáŋheža ki hená lowáŋpi	decl.
36	Those children are singing.	
37	**hiyá, wačhípi šni (..) ečháŋl lowáŋpi**	neg. + decl.
	No, they're not dancing. Instead, they're singing.	
38	**hiyá (.) wakȟáŋheža ki lowáŋpi**	decl.
	No. The children are singing.	
39	**hiyá (.) lowáŋpi**	decl.
	No, they're singing.	
40	**hiyá, wačhípi šni lowáŋpi**	neg. + decl.
	No. They're not dancing. They're singing.	
41	**wakȟáŋheža ki hená wačhípi he**	interr.
	Are those children dancing?	
42	**hiyá wačhíb- (.) wačhíb šni (..) lowáŋb**	neg. + decl.
	They're not dancing. They're singing.	

Table A.7: The Lakota phrases directly elicited from Della Bad Wound (2009). Although some general context was provided for the elicitations, the phrases listed in this table were not produced based on a conversational style "role-play" setting. The phrases were read by Della from a prepared list. Each item was repeated several times, on two different occasions. The sentences represent various modalities.

DBW09:E	**Lakota Phrase** English Translation	Modalities
1	**tág tókȟa he** What's happening?	interr.
2	**lakȟóta eyá wačhípi** Some Lakotas are dancing.	decl.
3	**na wakȟáŋheža eyá wačhípi** And, some children are dancing.	decl.
4	**takúku yuhápi he** What did they have?	interr.
5	**ptewániyaŋpi óta wičháyuhapi** They had lots of cattle.	decl.
6	**na makȟóče ki oíyokiphi** And the land was very pleasant.	decl.
7	**na wakȟáŋheža ki líla iyókiphipi** And the children were very happy.	decl.
8	**lakȟóta ki éča wačhípi** The Lakotas danced.	decl.
9	**na wakȟáŋheža ki éča wačhípi** And the children danced.	decl.
10	**lakȟóta ki ptewániyaŋpi wičháyuhapi** The Lakotas had cattle.	decl.
11	**lakȟóta ki ptewániyaŋpi óta wičháyuhapi** The Lakotas had lots of cattle.	decl.
12	**táku waŋláka he** What did you see?	interr.
13	**waŋblí eyá waŋwíčhablake** I saw some eagles.	decl.
	Continued on Next Page. . .	

DBW09:E	**Lakota Phrase** English Translation	Utterance Type
14	**waŋblí waŋ waŋbláke** I saw an eagle.	decl.
15	**ziŋtkála waŋ waŋbláke** I saw a bird.	decl.
16	**wakȟáŋheža waŋ waŋbláke** I saw a child.	decl.
17	**ptewániyaŋpi waŋ waŋbláke** I saw a cow.	decl.
18	**iyéčhiŋkiŋyaŋke waŋ waŋbláke** I saw a car.	decl.
19	**tuwé ča wačhípi he** Who was dancing?	interr.
20	**lakȟóta ki lená wačhípi** These Lakotas danced.	decl.
21	**lakȟóta ki lená wačhípi šni** These Lakotas did not dance.	neg.
22	**lakȟóta ki lená wačhípi he** Did these Lakotas dance?	interr.
23	**lakȟóta ki lená wačhípi kte** These Lakotas will dance.	irrealis
24	**lakȟóta ki lená wačhípi kte šni** These Lakotas will not dance.	irrealis neg.
25	**lakȟóta ki lená wačhípi kta he** Are these Lakotas going to dance?	irrealis interr.
26	**lakȟóta ki lená wačhípi kte šni** These Lakotas will not dance.	irrealis neg.
27	**lakȟóta ki lená wačhípi šni he** Didn't these Lakotas dance?	neg. interr.
28	**lakȟóta ki lená wačhípi (...) kte šni he** Aren't these Lakotas going to dance?	irrealis neg. interr.
29	**lakȟóta ki lená wačhípi kte (.) s'eléča** It seems that these Lakotas are going to dance.	irrealis conj.

Continued on Next Page...

DBW09:E	**Lakota Phrase** English Translation	Utterance Type
30	**lakȟóta ki lená wačhípi s'a** These Lakotas usually dance.	habit.
31	**lakȟóta ki lená wačhípi kšto** These Lakotas dance.	decl. emph.
32	**hokšíla ki lená wačhípi** These boys are dancing.	decl.
33	**wičhíŋčala ki lená wačhípi šni** These girls aren't dancing.	neg.
34	**hokšíla ki lená wačhípi he** Are these boys dancing?	interr.
35	**hokšíla ki lená wačhípi kte** These boys will dance.	irrealis
36	**wičhíŋčala ki lená wačhípi kte - kta he** Will these girls dance?	irrealis interr.
37	**wičhíŋčala ki lená wačhípi kte šni he** Aren't these girls going to dance?	irrealis neg. interr.
38	**wičhíŋčala ki lená wačhípi kte s'eléča** It seems that these girls are going to dance.	irrealis conj.
39	**hokšíla ki lená wačhípi s'a** These boys usually dance.	habit.
40	**hokšíla ki lená wačhípi kšto** These boys dance.	decl. emph.
41	**táku tókȟa he** what happened?	interr.
42	**tág tókȟa he** What happened?	interr.
43	**tókȟa he** What happened?	interr.
44	**sí mayázaŋ** My foot hurts.	decl.
45	**natá mayázaŋ** My head hurts.	decl.
	Continued on Next Page. . .	

DBW09:E	**Lakota Phrase** English Translation	Utterance Type
46	**natá ki mayázaŋ** My head hurts.	decl.
47	**ȟugnáǧe** It burned down.	decl.
48	**thí íle** The house is on fire.	decl.
49	**thi- thí íle** The house is on fire ...	decl.
50	**na waŋží (..) thí ki ȟnu- ȟugnáǧe** and one, the house, it burned down.	decl.

Table A.8: Small subset of phrases from a natural conversation between four Lakota speakers (2008). A few phrases from this conversation have been used in the intonational and prosodic analyses in Chapters 3 and 4. This tables display several segments of the conversation from which phrases were extracted for analysis. The left column indicates the code name of the speaker for each particular phrase; the codes for the four speakers are DBW, L2, L3, and L4.

DBW08:C	**Lakota Phrase**, English	Utterance Type
Clip 1		
DBW	**oglákaye tókhiyata "Red Scaffold" hé tóškhe eyáb so**	informal interr.
	That place called Red Scaffold, tell how they say that.	
L2	**wičhágnakapi šá'**	decl.
	Red Scaffold (in Lakota)	
DBW	**čha héčhiyataŋ yahí he -**	interr.
	So did you come from there?	
DBW	**I mean, lél yathí éyaš héčhiya (.) níthúŋpi he**	interr.
	I mean, even though you live here, were you born there?	
	...	
Clip 2		
L3	**hemátaŋhaŋ (..) ah Pine Ridge (.) él mathúŋb**	decl.
	I am from there, uh, I was born at Pine Ridge.	
DBW	**na lél waná yathí he**	interr.
	And now you live here?	
L3	**haŋ othúŋwahe lél waná tóna::: (..)**	decl. incomplete
	Yes, in this city now several umm ...	
DBW	**waníyetu (.) wikčémna númpa khiyéla**	decl. ?
	close to twelve years ...	
L3	**haŋ (.) ...**	decl.
	Yes, ...	
Clip 3		
L4	**míš (...) waŋblíhoȟpí (h)emátaŋhaŋ eyáš (..)**	
	As for me, I am from Wanbli, although	
	mathó (.) wakpá (.) él (.) imáčhaǧe	decl.
	I grew up at Bear Creek.	
	...	
	Continued on Next Page...	

DBW08:C	**Lakota Phrase**, English	Utterance Type
Clip 4		
DBW	**niš'éya tókhiyataŋ yahí ki ogláka ye**	polite imper.
	And you also, please talk about where you come from.	
DBW	**ničhíŋčha tóna na- níš (..) niš'éya omáyani he ki hená ogláka ye**	polite imper.
	How many children you have, and also your travels, those, please talk about them.	
	...	
Clip 5		
DBW	**iyúha héčhuŋk'uŋpi (..)**	decl.
	All of us do that.	
DBW	**čha níš (.) niš'éya (..) líla wayákšu s'elé:ča**	conj.
	And so you, you also, you do a lot of beadwork, it seems.	
	...	

Table A.9: The set of isolated words used for the acoustic analysis of lexical stress in Lakota. As explained in the analysis (section 3.2.2), this word list was prepared to specifically explore three dimensions of variation: the manner of release of word-onset velar stops, the Lakota vowels space, and lexical stress (i.e., first or second syllable stress). Items in this table correspond to data task code "DBW09:WE".

Lakota	English	**Lakota**	English
k'akhíyapi	they let him dig it	khiŋ'íŋ	he hurled s.t. at him
k'ápi	they dug it	khípi	they arrived at home
k'éȟ-hiŋglé	a sudden scratching sound came	khiyéla	near by
k'iŋkhíye	he loaded it on (eg. the horse)	khíze	he fought
k'íŋpi	they carried it on their back	kȟó	too, as well
k'ó	noise, confusion	kȟokípȟa	he's afraid
k'ukhíyapi	they let her give it to him	kȟolá	friend
k'úŋ	article, already mentioned	kȟowákipȟe	I'm afraid
k'úpi	they gave it to her	khúŋku	mother-in-law
káğapi	they made it	kȟuŋší	grandmother (pat.)
kaŋ ít'e	he died of old age	khúta	down
káŋpi	they were aged	khúta	down, below
kazé	he skimmed it (eg. milk)	khuté	to shoot
kekhíye	he said that to s.b.	kiŋyé	it flew
kéye	he said	kíŋže	he whined or moaned
kȟalyé	he heated it	kíze	he squeaked
kȟáŋta	plum	kižó	he whistled at s.b.
kȟaŋyéla	near	koskhíye	she let him wave it
kȟápišni	they did not mean	kóze	she waved it
kȟáte	it's hot (e.g. coffee)	kukhíye	she made him come back
khéya	turtle	kuŋsyá	pretending
kheyá ye	put up a shade.	kúŋze	she put a curse on him
khiglé	he set out for home	kúpi	they are on the way back
khíkta	he is going to take it away		

Table A.10: The Lakota words and phrases that functioned as "distractors" in the experiment for analysis of lexical stress. The words and phrases here were mixed with the target words in table A.9. The order of words in the resulting list was randomized. Each word/phrase was read three times, on two different occasions. Items in this table correspond to data task codes "DBW09:WE" and "DBW09:E".

Lakota Word	English	**Lakota Phrase**	English
máza	metal	eša míla wanží bluhá šni	I wish I had a knife.
pápa	dried meat	háŋpa uŋkíkčhağapi	We made our own shoes.
pȟaŋpȟáŋžela	soft	hé kȟóya áya ye	Take that as well.
pȟáte	to cut up	naháŋȟči kiŋyáŋpi šni	They cannot fly yet.
t'áğe	bitter	ok'ó-hiŋglé	There was a sudden noise.
t'ápi	they died	pahátakiya napé kóze	He waved his hand toward the hill.
tȟáŋka	big	wakȟáŋheža ki wówapi k'íŋpi	The children carried books on their back.
tȟaté	wind	waníyetu óta ní úŋ na héchel káŋ ít'e	He lived many years a died of old age.
tȟažhúška	ant	wígli ki áta kazépi	They skimmed the fat.
tȟezí	stomach		
okȟólakičhiye	societies		
tuwéni	nobody		
wakȟáŋheža	child		
wayáwapi	reading		

Appendix B

Abbreviations and Symbols

The following tables list the abbreviations and symbols that are used throughout the text to code the data. The first table lists the symbols used for coding word classes and prosodic features in the data. The second table lists the symbols used for coding the grammatical information in the inter-linear glossing of the affixes and enclitics.

	Word Classes		**Prosodic**	
	symbol	meaning	symbol	meaning
	ADV	adverb	DS	downstep
	COMP	compound	IP	intonational phrase
	CONJ	conjunction	ip	intermediate phrase
	DEM	demonstrative	ω	word
	DET	determiner	=	enclitic boundary or syntactic compound
	PP	postposition	-	lexical compound
	PRN	pronoun		
	QUANT	quantifier		
	REDUP	reduplicated verb form		
	V-IMP	impersonal verb		
	V-S	stative verb		

Table B.1: Abbreviations used for Coding Word Classes and Prosodic Features.

	Affixes		**Enclitics**	
	symbol	meaning	symbol	meaning
	1.agt.2.pat	1st person agent-second person patient	asp	aspectual
	1.nsg	1st person non-singular	assert	assertion
	1.sg	1st person singular	att	attenuated
	2.sg	2nd person singular	conj	conjectural
	3.sg	3rd person singular	decl	declarative
	advz	adverbializer suffix	dim	diminuative
	agt	agent	emph	emphatic
	anim	animate	hab	habitual
	caus	causative	imp	imperative
	def	definite	interr	interrogative
	hyp	hypothetical	intsf	intensifier
	indef	indefinite	irr	irrealis
	nomz	nominalized	neg	negation
	obj	object	quot	quotative
	pat	patient		
	pfx	prefix		
	pl	plural		
	pos	possessive		
	real	real		
	refl	reflexive		
	rel	relativizer		
	sg	singular		

Table B.2: Abbreviations used for coding the meaning of affixes and enclitics in the inter-linear glosses.